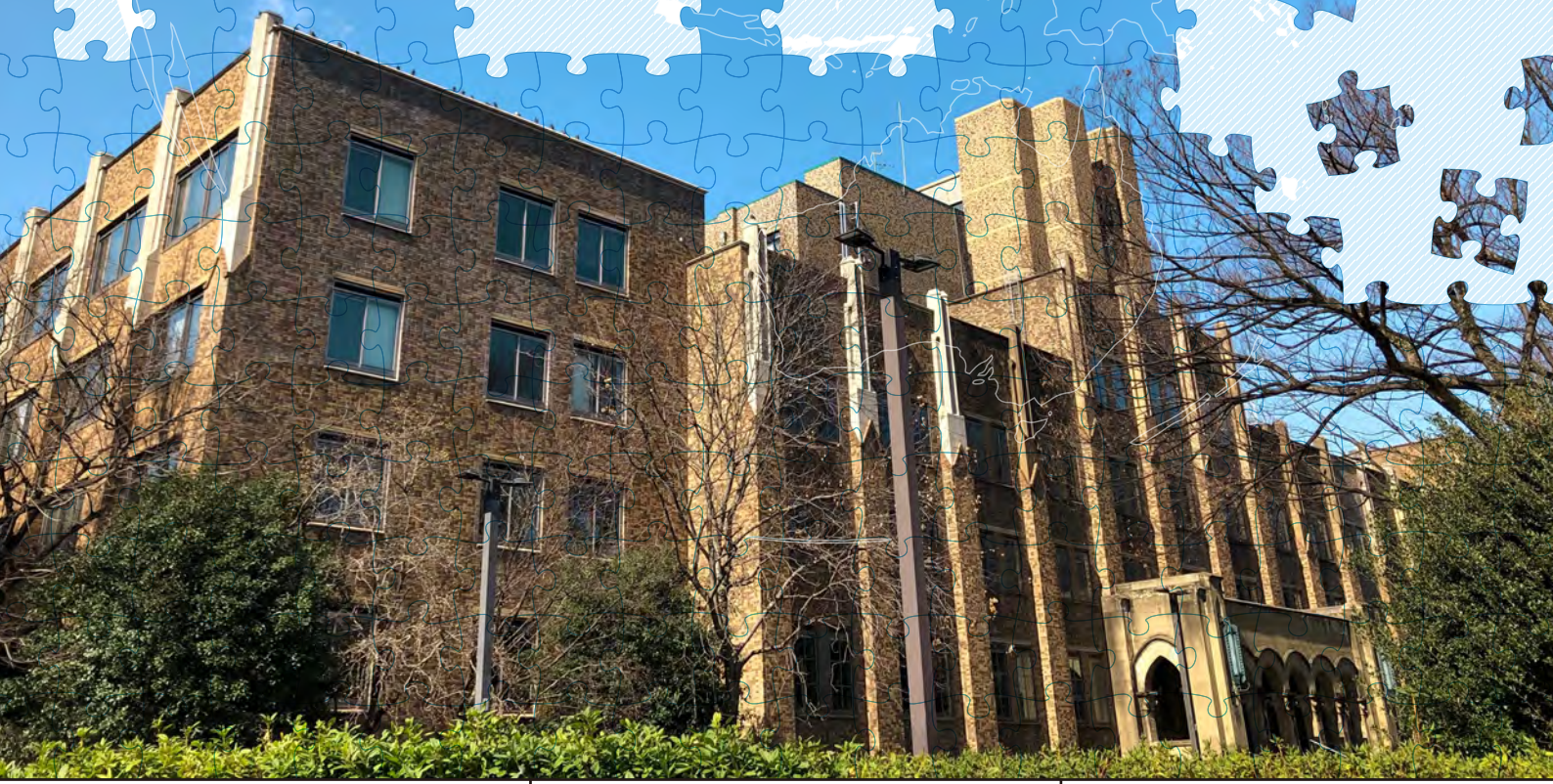
CSRDA
Center for Social Research and Data Archives, Institute of Social Science, The University of Tokyo
SUSTAINABLE DEVELOPMENT GOALS
CSRDA supports the Sustainable Development Goals

CSRDA Discussion Paper

Does single-sex education strengthen attitude toward gender role? Causal inference approach using Japanese survey data



No. 48

Date Jun. 2023

SDGs 4 QUALITY EDUCATION · 5 GENDER EQUALITY · 16 PEACE, JUSTICE AND STRONG INSTITUTIONS

Name Kazuhiro Kezuka, Shoki Okubo, Hiroki Takikawa

Does single-sex education strengthen attitude toward gender role? Causal inference approach using Japanese survey data

Kazuhiro Kezuka*, Shoki Okubo†, and Hiroki Takikawa‡

Abstract

Several studies have been published on the effect of single-sex education. However, these studies on single-sex schools have two problems: 1) they focus on the effect on academic performance and 2) they heve not estimated with causal inference.

In this study, resolving these two problems, we estimate the causal effect of single-sex schools on gender role attitudes using Japanese data. The data are nationally representative for junior high and high school students and contains information about respondents' parents. To estimate the causal effect, we employed the IPW estimation method using the propensity score based on the information of the parents. Attending single-sex schools was the treatment variable, and the outcome variable was the attitudes toward gender roles for child-bearing.

*National Institute of Population and Social Security Research, kezuka-kazuhiro@ipss.go.jp
†The University of Tokyo
‡The University of Tokyo

The results indicate that, contrary to previous research, boys' schools did not strengthen their gender attitudes, while girls' schools strengthened their gender attitudes. This result was possibly because of oversocialization in girls' schools in the Japanese male-dominant society.

Introduction

Debate over single-sex education

A heated debate is raging over the effectiveness of single-sex education [1]. Some researchers present that single-sex education improves students' academic performances. For instance, Park et al. [2] shows that, in Seoul, students in single-sex schools have better academic score in language tests (English and Korean) than those in co-educational schools. Pahlke et al. [3] conducted a meta-analysis, which shows that single-sex schools improve students' academic achievements.

In addition, there has been a trend to promote single-sex education in the US. The National Association for Single-Sex Public Education (NASSPE), grouped by Leonard Sax, reports the efficacy of single-sex educations, that is, single-sex education improves students' academic performance [4]. Title IX of the US. Education Amendments of 1972, amended in 2006, permits implementation of single-sex classes within co-educational schools and establishment of new single-sex schools.

However, other researchers express their doubts about the effects of single-sex schools. Halparn et al. [6] explains two points about single-sex education research, which could apply to all the studies on the effects of single-sex schools: 1) incorrect methods and 2) possibility of reinforcing prejudices.

1) Lack of causal inference

First, the research on the effect of single-sex schools have given little attention to causal inference [1, 6]. As shown in the later section, we cannot ignore parental influence on children from the viewpoint of socialization. Some literature show that parents' attitudes affect children's attitudes [7].

Parents have strong influence on choosing the school their children would attend and have a strong influence on their attitude. Parents' attitudes may cause selection bias. Those who support gender roles may send their children to single-sex schools.

Hence, parental influence is a confounding factor between single-sex education and attitude. To estimate the causal effect of single-sex education, these confounding factors must be eliminated or diminished. Although some researches utilize (quasi-)experimental situations [2, 9, 10], estimating the causal effect of single-sex education remains a challenge.

2) Little attention to gender bias

Most studies on single-sex education focus on its effect on academic achievement rather than on attitude toward gender role or gender biases [6, 11]. Halpern et al. [6] point out that single-sex education has the potential to strengthen students gender bias. There are a few previous researches, which study the effect of single-sex education on gender attitude or stereotypes; however, their results are mixed.

Some researches indicate that single-sex education may strengthen gender bias. Wong et al. [11] show that those who attend single-sex schools have more gender salience than those who attend co-educational schools. Erarslan et al. [12] show that single-sex education strengthens girls' attitudes toward gender roles in Istanbul, Turkey. This result was supported even though the

demographic variables of girls' parents were controlled.

Other researches show mixed results. Pahlke et al. [3] conducted a meta-analysis of the researches which explores the effect of single-sex education on gender stereotypes. The results are ambivalent. Co-education slightly strengthened their gender bias in the weighted data; however, the same could not be confirmed in the unweighted one. Lee and Lockheed [13] analyzed randomly sampled data from Nigeria. They show that single-sex schools increase girls' academic performance in math and decrease the gender stereotype against girls in math. However, the boys in single-sex schools had inverse results. They performed poorly and were strongly stereotyped.

Aim of this study

In this study we attempt to estimate the causal effect of single-sex education on gender role attitudes using Japanese data by tackling two problems.

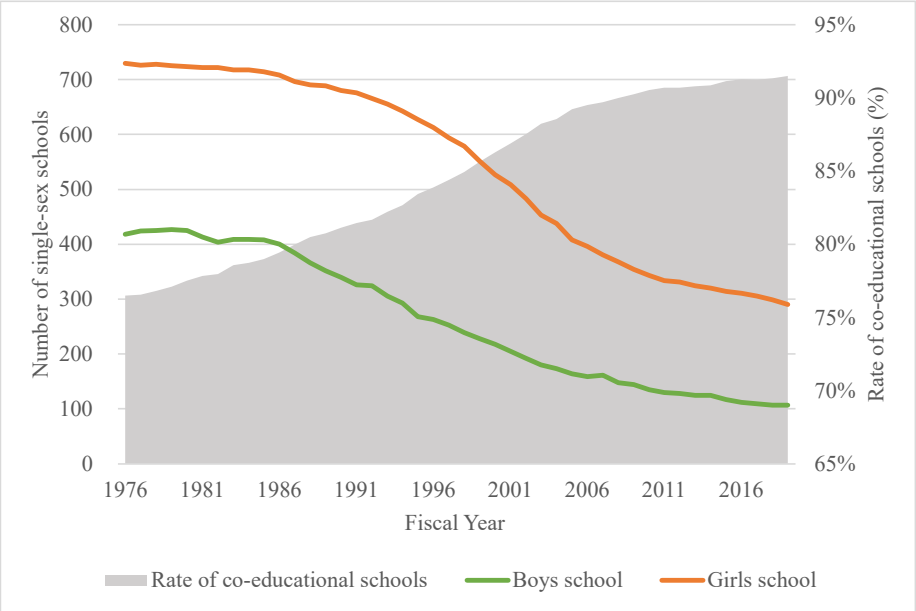
First, we explain the Japanese education situation and previous research on the subject in Japan. Second, we overview the theories, explaining the relationship between single-sex education and gender role attitude, and establish an analytical strategy. Finally, we estimate the causal effect of single-sex schooling and provide result interpretations of them.

Single-sex education in Japan

In Japan, the education system is largely divided into four stages: elementary school for six years, junior high school for three years, high school for three years, and university for four years. Elementary school and junior high school are compulsory education.

Single-sex schools are primarily junior high and high schools; however, number of single-sex schools is decreasing. Fig 1 shows the number of single-sex

Figure 1: **Single-sex Education in Japan (School Basic Survey, MEXT)**

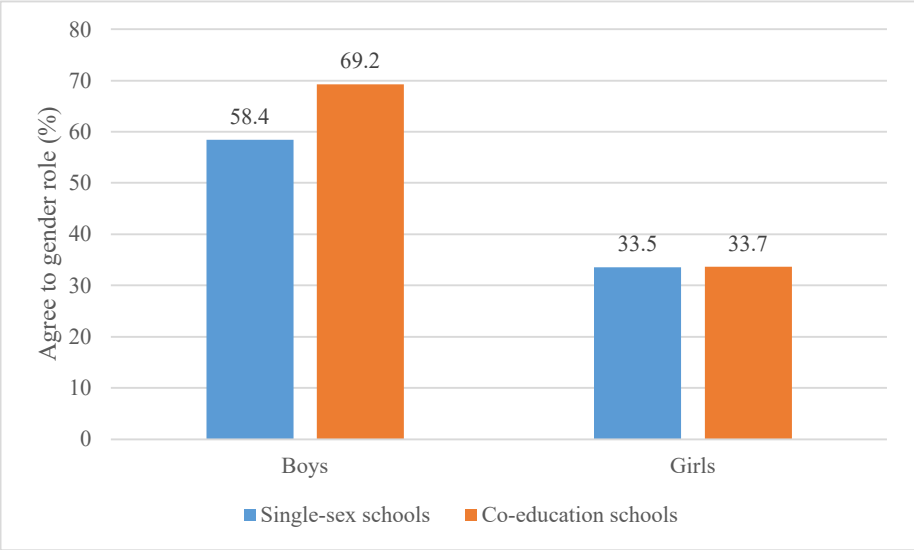


high schools and the percentage of co-educational schools. The ratio of co-educational schools has increased from 75 % to 90 % from 1976 to 2016. In addition, Fig 1 indicates that the number of single-sex schools are decreasing.

Although single-sex schools are on the decline, they are still present in the Japanese society. Certain single-sex schools have shown top level academic performance, regardless of public or private schools, thus, some authors publish books which adovocate the superiority of single-sex education to parents (e.g. [19]).

Related to our research, Ehara [18] conducted a survey on high-school students in Tokyo in 1994 and 1995. This survey shows that boys in boys schools have the strongest attitude toward gender roles. Fig 2 shows the result of Ehara's survey. As shown in Fig 2, boys were more likely to agree with gender roles than girls, and boys in boys schools were more likely to agree than boys in co-educational schools. In addition, Fig 2 shows that, among girls, there was no

Figure 2: **Gender Role Attitudes of High School Students [18]**



difference in the rate of agreement between single-sex schools and co-educational schools.

Ehara provides the following interpretation of her results. First, girls schools educated girls to have gender-equal values and promote women's empowerment in the male-dominated society.

Second, in co-educational schools, both boys and girls received an education based on gender-equal values. When boys encountered girls who opposed gender-based division of labor, they would adjust their own gender role attitude.

However in boys' schools, neither of these case holds true. Boys in boys schools are expected to go to high-level universities (e.g., The University of Tokyo) and find jobs as breadwinners. This expectation was not corrected by girls as in co-educational schools.

Ehara's study, and other studies (e.g., [13]), suggest that single-sex education strengthens gender bias among boys. However, her study was not designed to estimate the casual effect. One of our contributions is this estimation problem

in the Japanese context.

Theory and analytical strategy

We review four theoretical frames, which indicate that single-sex education strengthens students' gender bias. With these theories, we plan our analytical strategy for causal inference in the next section.

Development intergroup theory

The development intergroup theory (DIT) explains the process through which children attain prejudices and discrimination [14]. The DIT predicts that prejudices are strengthened within a group under four conditions: 1) perceptual discrimination, 2) proportional group size, 3) explicit label use, and 4) implicit use of category. From the perspective the DIT, single-sex schools satisfy these four conditions and have the potential to strengthen gender bias [3].

Peer socialize effect

Peer socialize effect suggests that gender-segregated interactions in schools strengthen gender-specific traits [5]. Adler and Adler [15] show that, in elementary school, popularity characteristics were different for boys and girls, which enhanced their significance through interaction within single-gender groups. For instance, ideals for boys were related to athletic ability or toughness, while those for girls were related to family background or physical appearance. As this study shows, living in a homogeneous peer group could reinforce certain ideas.

Contact hypothesis

Contact hypothesis [16] has similarities with the peer socialize effect. Contact hypothesis suggests that contact opportunities with different social categories reduces stereotyping toward those categories. Hence, co-education may result in lower gender stereotyping toward the opposite sex than single-sex education.

Expectancy theory

Expectancy theory suggests that stereotypical expectancies affect stereotype formation. Eccles et al. [7] show that parental gender bias about math performance influences children's math performances. Hence, if a mother believes that men are more likely to succeed in math than women, her daughter's academic math score would be lower than her son's. However, if a mother believes that men and women have equal mathematical talent, the gender of the child would make no difference to the child's math academic performance. This result indicates that parents' expectancy may form a child's attitudes.

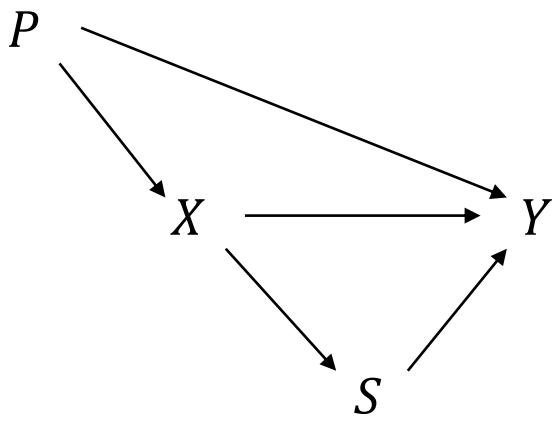
Analytical strategy

From these four theories, we can illustrate the DAG (directed acyclic graph), as shown in Fig 3.

X is the treatment variable: attending single-sex school. $X = 1$ stands for attending single-sex schools and $X = 0$ stands for attending co-educational schools. We denote Y as the outcome variable: attitude toward gender roles. $Y = 1$ represents supporting gender roles, while $Y = 0$ represents opposing gender roles. X and Y are both dichotomous variables. We want to estimate the causal effect from X to Y.

The DIT, peer socialize theory, and contact hypothesis indicate that single-sex schools make gender imbalanced circumstances, which may strengthen stu-

Figure 3: **DAG of Estimating the Causal Effect of Single-sex Education**



dents' gender bias. In the DAG (Fig 3), this is equivalent to $X \to S \to Y$, where S stands for school circumstances.

Expectancy theory suggests that parents' expectancy affects both, gender bias and whether children attend single-sex schools or not. This is equivalent to $P \to X$ and $P \to Y$ in the DAG, where P stands for parents' influences.

To estimate the causal effect, we must not control S. Controlling S leads to intermediate variable bias [17]. We do not control the variables of schools in this analysis.

P is a confounder, which we have to control. We employ inverse probability weighting estimation (IPW estimation) to manage parents' information. IPW estimation is a method for estimating the causal effects by generating pseudo-random-assignment-like situations using propensity scores, which are estimates of assignment probabilities [8]. In this study, the assignment is attending single-sex schools.

We estimated the probabilities of students' attending single-sex schools $\hat{e}(X)$ with the logistic regression model below, where $\text{logit}(p) = 1/(1 + \exp(-p))$ was

the logistic function.

$$\hat{e}(X) = \text{logit}(\hat{\delta_0} + \hat{\delta}\mathbf{P}) = \frac{1}{1 + \exp(-(\hat{\delta_0} + \hat{\delta}\mathbf{P}))}. \tag{1}$$

With this propensity score $\hat{e}(X)$, we weight the data to estimate the causal effect. We estimate two types of causal effects: average treatment effect (ATE) and average treatment effect on treated (ATT).

The ATE shows the difference of the percentages for those who support gender role between two counter factual situations: if all the students attended single-sex schools and if all the students attended co-educational schools.

$$ATE = E(Y^{X=1}) - E(Y^{X=0}), \tag{2}$$

where $Y^{X=i}$ stands for the random variable for the outcome variable if the students were treated as $X = i$ $(i = 0, 1)$. The ATT indicates that ATE among those who receive treatment, which means attending single-sex schools in this study, as defined below:

$$ATT = E(Y^{X=1}|X = 1) - E(Y^{X=0}|X = 1). \tag{3}$$

To estimate the ATE and ATT, we weighted the data in the analysis with w_i, where

$$w_i = \begin{cases} \frac{X_i}{\hat{e}(X_i)} + \frac{1-X_i}{1-\hat{e}(X_i)} & \text{for ATE} \\ X_i + \frac{1-X_i}{1-\hat{e}(X_i)} & \text{for ATT} \end{cases}.$$

We analyzed the three models below with both unweighted and weighted

variables.

$$\text{Model 1: } Y = \alpha + \beta X. \tag{4}$$

$$\text{Model 2: } Y = \alpha + \beta X + \boldsymbol{\gamma}\mathbf{Z}. \tag{5}$$

$$\text{Model 3: } Y = \alpha + \beta X + \boldsymbol{\gamma}\mathbf{Z} + \boldsymbol{\delta}\mathbf{P}. \tag{6}$$

In Model 1 (Eq (4)), we did not control any variables. In Model 2 (Eq (5)), we controled the student-related variables. In Model 3 (Eq (6)), all the variable including the variables $\mathbf{P}$, used in the estimation of propensity score, were controled. Model 3 provides least biased estimation of the causal effect.

Data

To estimate the causal effect, we used the data from “The Survey on the Way of Life and Attitudes of Junior and Senior High School Students, 2012.” This survey was conducted by the NHK Broadcasting Culture Research Institute and randomly sampled from 12 to 18 years old students attending Japanese junior high and high schools. This survey asked questions the respondents and their parents; this survey is triad data. This feature enabled us to consider parents' attitudes toward gender role, and we could estimate the causal effect of single-sex schools. See Tab 1 for the basic statistics of the variables used in this analysis.

Table 1: **Basic Statistics**

	Boys	$N = 331$	Girls	$N = 342$
	Mean/Freq.	S. D.	Mean/Freq.	S. D.
Outcome:				
Gender Role Attitude	0.414	0.493	0.485	0.501
Treatment:				
Single-Sex Schooling	0.045	0.208	0.073	0.261
Control:				
High School Students	0.483	0.500	0.515	0.501
Academic Score	2.976	1.092	3.211	0.988
Propensity Score:				
Propensity Score	0.045	0.096	0.073	0.161
Resident City Size				
1. 1M+	47		48	
2. 300K+	76		74	
3. 100K+	95		89	
4. 50K+	42		62	
5. Less than 50K	69		69	
Father:				
Age	47.48	5.551	47.13	5.449
Job				
1. Primary Industry	10		10	
2. Self-employed (0-9 employees)	38		51	
3. Self-employed (10+ employees)	9		6	
4. Manager	51		47	
5. Sales/Service	23		31	
6. Skilled	78		100	
7. Office/Technical	105		77	
8. Professional/Free	13		14	
11. Unemployed	4		6	
Education				
1. Junior High School	18		25	
2. High School	135		165	
3. Technical College/Junior College	38		32	
4. University	140		120	
Gender Role Attitude				
1. mother all	45		63	
2. mainly mother	185		221	
3. equally	94		55	
4. mainly father	4		2	
5. father	0		1	
Mother:				
Age	45.26	4.681	45.09	4.652
Housewife	0.514	0.501	0.557	0.498
Education				
1. Junior High School	2		11	
2. High School	169		173	
3. Technical College/Junior College	119		110	
4. University	41		48	
Gender Role Attitude				
1. mother does all	48		50	
2. mainly mother	185		198	
3. equally	94		90	
4. mainly father	4		4	
5. father does all	0		0	

Outcome variable

The outcome variable was the attitude toward gender role in caring for a child. We used the answer to the following question: How much chaildcare responsibility would you share if you marry and have a child?

Students chose one of the five options: a) a mother does all the childcare, b) mainly a mother does the childcare, and a father helps her, c) a mother and a father are equally involved in the childcare, d) mainly a father does the childcare, and a mother helps him, and e) a father does all the childcare.

We recoded this variable into the dummy variable, which we called "Division of Childcare variable." It takes one if and only if he or she answers a) or b) to the question, or else it takes zero.

Treatment variable

The treatment variable was a dummy variable whether they attended a single-sex school or not.

Variables to estimate the propensity score

To estimate the propensity score, we used the covariates, which affected both outcome and treatment variables. We utilized these variables to estimate the propensity score: parents' education, parents' occupation, parents' attitude toward gender role in caring for a child and the size of the resident city. The estimation of the propensity score is presented in Tab 2.

As for the father's occupation, the following eight types were used as categorical variables: primary industry worker, self-employed (less than nine employees/more than ten employees), manager in a company with more than 50 employees, sales/service worker, skilled worker, office/technical worker, professional/free occupation, househusband, and unemployed.

Table 2: **Estimation of Propensity Score**

	Boys	$N = 331$		Girls	$N = 342$	
	Coeff.	S.E.		Coeff.	S.E.	
Const.	-13.34	7.920×10^3		-27.14	3.335×10^3	
Resident City Size						
1. 1M+	ref.			ref.		
2. 300K+	0.4589	1.264		-1.284	0.8406	
3. 100K+	1.606	1.179		-2.321	0.9239	*
4. 50K+	-17.62	3.067×10^3		-1.997	0.9592	*
5. Less than 50K	1.196	1.382		-4.567	1.607	**
Father:						
Age	0.0334	0.0958		0.1092	0.0964	
Job						
1. Primary Industry	ref.			ref.		
2. Self-employed (0-9 employees)	-2.702	1.542	+	-3.355	1.608	*
3. Self-employed (10+ employees)	-2.124	1.724		0.3755	1.717	
4. Manager	-3.020	1.589	†	-5.344	1.893	**
5. Sales/Service	-21.80	4.590×10^3		-21.53	2.488×10^3	
6. Skilled	-20.88	2.492×10^3		-3.819	1.639	*
7. Office/Technical	-3.328	1.468	*	-3.941	1.637	*
8. Professional/Free	-2.791	1.852		-2.021	1.657	
11. Unemployed	-21.14	3.892×10^3		-21.33	4.620×10^3	
Education						
1. Junior High School	ref.			ref.		
2. High School	0.2625	1.909		-2.677	1.435	+
3. Technical College/Junior College	1.206	1.911		-2.318	1.714	
4. University	1.366	1.915		-1.914	1.475	
Gender Role Attitude						
1. mother does all	ref.			ref.		
2. mainly mother	-0.7897	1.155		0.1251	0.9385	
3. equally	-1.230	1.530		-0.1959	1.207	
4. mainly father	-18.93	3.889×10^3		-16.33	1.169×10^4	
5. father	—			2.352	1.161×10^4	
Mother:						
Age	-0.1715	0.1228		0.1305	0.1065	
Housewife	1.439	0.8228	†	0.7497	0.6391	
Education						
1. Junior High School	ref.			ref.		
2. High School	15.82	7.920×10^3		17.15	3.335×10^3	
3. Technical College/Junior College	17.99	7.920×10^3		19.78	3.335×10^3	
4. University	17.72	7.920×10^3		18.81	3.335×10^3	
Gender Role Attitude						
1. mother does all	ref.			ref.		
2. mainly mother	0.4714	1.073		0.4763	1.015	
3. equally	-0.1802	1.371		2.312	1.134	*
4. mainly father	-16.25	9.628×10^3		-17.18	5.218×10^3	
5. father does all	—			—		

$+ : p < 0.10, * : p < 0.05, ** : p < 0.01$

The mother's job was recoded into a dummy variable whether she was a housewife or not. In this data, unemployed fathers were rare (about 1%), while unemployed mothers were relatively high (more than 50%). If a married woman was unemployed, she was likely to be a housewife and we expected that the gender attitudes of children with housewife mothers would be stronger than the gender attitudes of employed mothers. We considered whether students' mother's occupational status could have had critical effect on students' attitudes; hense, we recoded the mother's job as the dummy variable of housewife.

In addition, we used the residing city size because this variable determined accessibility to single-sex schools and the gender attitudes of the students and their families.

Control variables

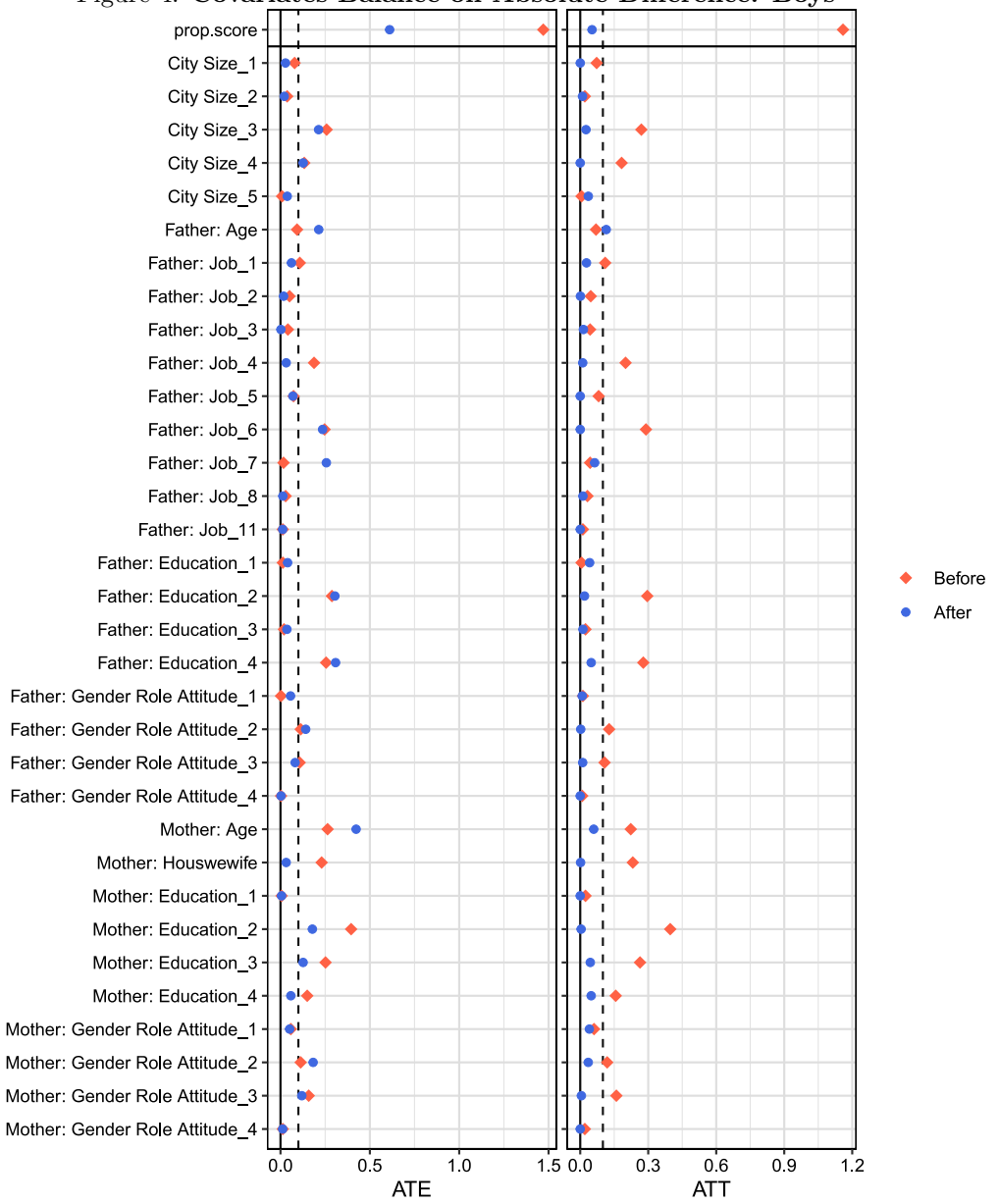
In Models 2 and 3, we controlled variables on students' profiles: whether they attended high school or junior high school and their academic performance in their current class, which was measured on a five-point scale.

Balance of covariates

Fig 4 and 5 present the balance on variables used to estimate the propensity score. We omitted the samples whose propencity score was lower than 0.01 to prevent the occurence of too large a weight. The absolute differences d indicate the standardized difference of means between the treated and the control group and they are desirable to be less than 10%, represented by the dotted line in Fig 4 and 5. The labels of the variables correspond with those in Tab 1.

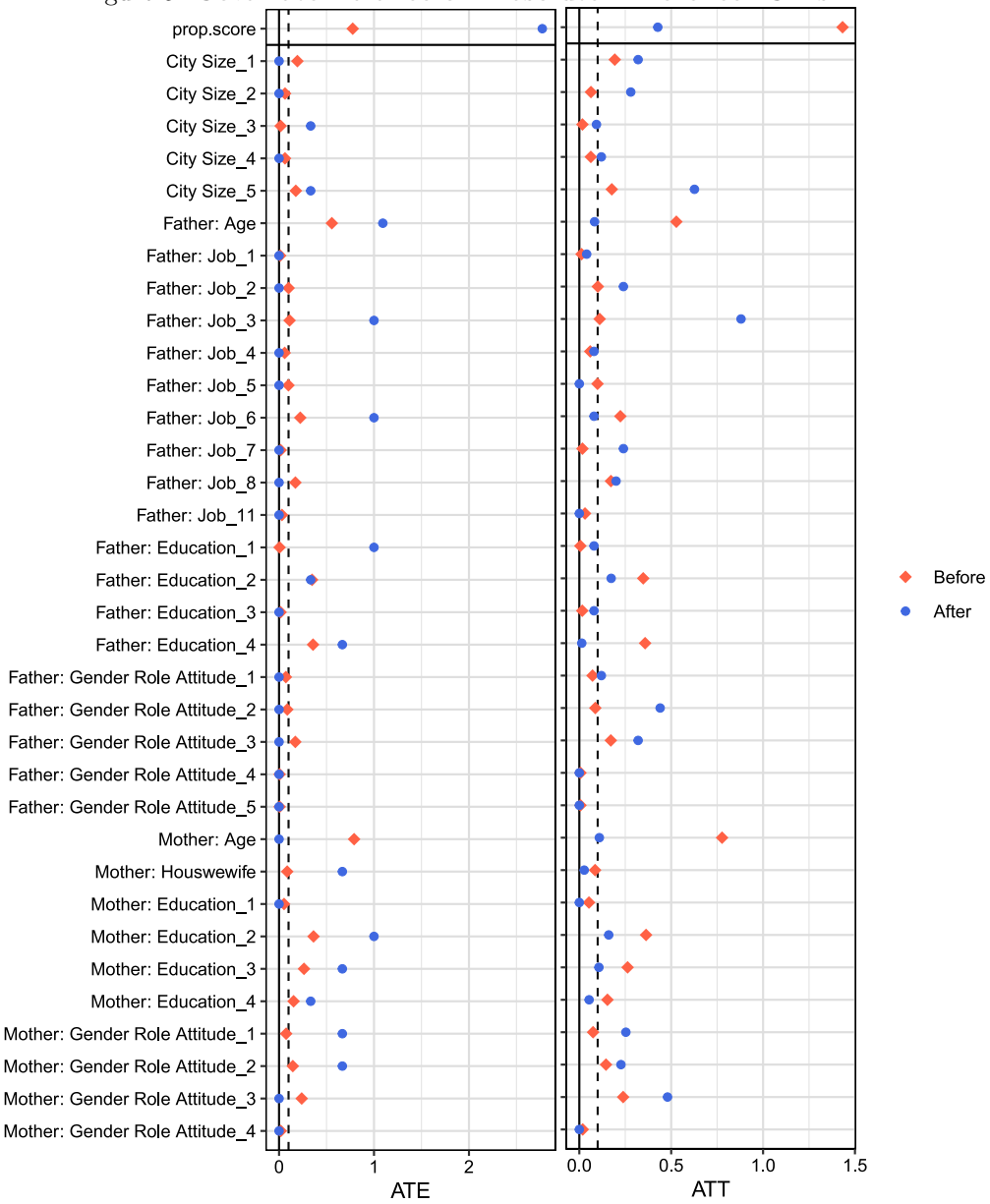
On the ATE, some variables were not well balanced even after begin weighted, while, on the ATT, most of the variables were well controlled. This meant that the ATT provides a less biased estimation than the ATE. Although the bal-

Figure 4: **Covariates Balance on Absolute Difference: Boys**



ance on the ATE was undesirable in some variables, we prioritized to follow the theory and allowed bias to a certain extent.

Figure 5: **Covariate Balance on Absolute Difference: Girls**



Result

Tab 3 presents single-sex education and gender attitude. On the whole, girls were more likely to agree with gender roles than boys. When we see the raw

effect of single-sex schools, boys in single-sex schools(33%) were less likely to agree than those in co-educational schools(42%). Girls, however, had an opposite tendency (60% in single-sex schools and 47% in co-educational schools).

Table 3: Attending single-sex schools and division of child care

	Division of Childcare					
	Boys			Girls		
	Disagree ($Y=0$)	Agree ($Y=1$)	Total	Disagree ($Y=0$)	Agree ($Y=1$)	Total
Co-ed. ($X=0$)	184 (58.23)	132 (41.77)	316 (100.0)	166 (52.37)	151 (47.63)	317 (100.0)
Single-Sex ($X=1$)	10 (66.67)	5 (33.33)	15 (100.0)	10 (40.00)	15 (60.00)	25 (100.0)
Total	194 (58.61)	137 (41.39)	331 (100.0)	179 (51.46)	169 (48.54)	348 (100.0)

Tab 4 presents the results of the nine models. On the whole, single-sex schools had negative effects in boys, while it had positive effects on girls, which shows that single-sex schooling strengthened girls' gender attitudes.

For the boys, all coefficients were negative, around -0.08. Model 3 of the ATT, which has least bias, showed negative significant coefficient while the other models had no significant effect. These results indicates that the causal effect of single-sex education on boys was either weak or absent. If single-sex schooling had effects on boys, it should lessen their gender bias.

In girls, unlike boys, we observed significant positive effects for both the ATE and ATT. For instance, in the ATE Model 3, the coefficient of single-sex schooling was 0.310. This result indicates that if all the girls attended girls' schools, the number of girls who agree with gender roles would increase by 31%.

Table 4: Result of Estimation: Effect of Single-Sex school

		Boys			Girls		
		Coef.	S. E.		Coef.	S. E.	
Unweighted	Model 1	-0.084	0.130		0.124	0.104	
	Model 2	-0.086	0.131		0.165	0.105	
	Model 3	-0.082	0.140		0.117	0.117	
ATE	Model 1	-0.079	0.061		0.453	0.042	***
	Model 2	-0.085	0.062		0.492	0.050	***
	Model 3	-0.085	0.071		0.310	0.068	***
ATT	Model 1	-0.085	0.053		0.135	0.054	*
	Model 2	-0.082	0.054		0.138	0.054	*
	Model 3	-0.086	0.044	†	0.143	0.047	**

***:$p < 0.001$,**:$p < 0.01$,*:$p < 0.05$,†:$p < 0.10$.

Discussion and Conclusion

In this study, we estimated the causal effects of single-sex schooling on gender-role attitudes with the triad data in Japan containing variable of the correspondents and their parents. The results showed different tendencies in boys and girls; single-sex schools did not affect the gender-role attitude of boys, while they reinforced the attitude of girls.

Our results differed from Ehara's result that boys' schools intensified gender bias. Two reasons explain this difference. First is the change in gender attitudes. The data we used was collected in 2012: twenty-seven years after Ehara's survey data, which was collected in 1994 and 1995. Although the Gender Gap Index (GGI), which is reported by The World Economic Forum, has not been improved in Japan [20], agreement on gender roles has decreased among Japanese people.

For instance, some surveys showed that, 56% of Japanese people agreed with "even after a woman is married and has children, she should, as far as possible, continue working" in 2013, while 37% of Japanese people who agreed with this opinion in 1993 [21]. This trend reflects our results, especially in boys.

The second reason is related to the estimation with causal inference. Ehara's result was derived from simple tabulation and did not treat selection bias. However, we analyzed the data by considering selection bias, hence, we could estimate the causal effect of single-sex schools, especially in girls.

We consider oversocialization a possible interpretation for these results. The DIT and peer socialize effect predict that an environment, such as a single-sex school, amplifies gender stereotype. Girls in single-sex schools may receive the information that women have disadvantages after graduation. This may promote gender role bias by peer socialization. In co-educational schools, as the DIT suggests, interaction with boys may reduce girls' gender bias.

However, boys are expected to be bread winners, hence the expectation for them are no different in single-sex schools or co-educational schools. This may be the reason why we could not observe the effect.

Limitation

This study has a limitation with data. In the data used, the number of students who attended single-sex schools was less than 100. This may be too small a sample to estimate the causal effect. A larger sample, or quasi-natural experiment data set would be required to estimate the causal effect of single-sex schools.

In addition, we point out the possibility of socially desirable bias in boys. Japan has a large gender gap, hence, the answers of gender equality satisfy social desirability, especially for men. Considering this type of social desirability, boys, whether attending boys schools or co-educational schools, may answer gender

equal options while they believe that women should take care of children.

However, our study is important. The understanding of gender role attitude and causal inference provides insight into the Japanese society and suggestions for future reserch methodologies for single-sex education.

Acknowledgement

The data for the secondary analysis, “The Survey on the Way of Life and Attitudes of Junior and Senior High School Students, 2012 (Public Opinion Research Division, NHK Broadcasting Culture Research Institute),” was provided by the Social Science Japan Data Archive, Center for Social Research and Data Archives, Institute of Social Science, The University of Tokyo.

References

[1] Pahlke E, Hyde JS. The Debate Over Single-Sex Schooling. Child Development Perspectives. 2016;10(2):81–86.

[2] Park H, Behrman JR, Choi J. Causal Effects of Single-Sex Schools on College Entrance Exams and College Attendance: Random Assignment in Seoul High School. Demography. 2013;50(2):447–469.

[3] Pahlke E, Hyde JS, Allison CM. The Effects of Single-Sex Compared With Coeducational Schooling Students' Performance and Attitudes: A Meta-Analysis. Psychological Bulletin. 2014;140(4):1042–1072.

[4] Sax L. Single-Sex vs. Coed: The Evidence. National Association for Single Sex Public Education. 2006 [cited 12 Apr 2022]. Available:http://www.mcrcad.org/evidence.html.

[5] Hanish LD, Fabes RA. Peer socialization of gender in young boys and girls. In: Tremblay RE, Boivin M, Peters RDeV, editors. Encyclopedia on Early Childhood Development. Montreal, Quebec: Centre of Excellence for Early Childhood Development and Strategic Knowledge Cluster on Early Child Development; 2014. pp. 1–4. Available from: http://www.child-encyclopedia.com/sites/default/files/textes-experts/en/2492/peer-socia

[6] Halparn DF, Eliot L, Bigler RS, Fabes RA, Hanish LD, Hyde J, et al. The Pseudoscience of Single-Sex Schooling. Science. 2011;333(6050):1706–1707.

[7] Eccles JS, Jacobs JE, Harold RD. Gender Role Stereotypes, Expectancy Effects, and Parents' Socialization of Gender Differences. Journal of Social Issues. 1990;46(2):183–201.

[8] Stuart EA. Matching Methods for Causal Inference: A Review and a Look Forward. Statistical Science. 2010;25(1):1–21.

[9] Eisenkopf G, Hessami Z, Fischbacher U, Ursprung HW. Academic performance and single-sex schooling: Evidence from natural experiment in Switzerland. Journal of Economic Behavior & Organization. 2015;115:123–143.

[10] Dustmann C, Ku H, Kwak DW. Why Are Single-Sex Schools Successful? Labour Economics. 2018;54:79–99.

[11] Wong WI, Shi SY, Chen Z. Students from single-sex schools are more gender-salient and more anxious in mixed-gender situations: Results fromhigh school and college sample. PLoS ONE. 2018;13(12):e0208707.

[12] Erarslan AB, Rankin B. Gender Role Attitudes of Female Students in Single-Sex and Coeducational High Schools in Istanbul. Sex Roles. 2013;69:455–468.

[13] Lee VE, Lockheed ME. The Effects of Single-Sex Schooling on Achievement and Attitudes in Nigeria. Comparative Education Review. 1990;34(2):209–231.

[14] Bigler RS, Liben LS. A developmental intergroup theory of social stereotypes and prejudice. Advances in child development and behavior. 2006;34:39-89.

[15] Adler PA, Adler P. Peer Power: Preadolescent Culture and Identity. New Jersey: Rutgers University Press; 1998.

[16] Allport GW. The nature of prejudice. Cambridge: Perseus Books; 1954.

[17] Schisterman EF, Cole SR, Platt RW. Overadjustment Bias and Unnecessary Adjustment in Epidemiologic Studies, Epidemiology. 2009;20(4):488–495.

[18] Ehara Y. Feminism no Paradox: Teichaku ni yoru kakusan [Paradox of Feminism: Diffusion with Establishment]. Tokyo: Keisou Syobou; 2000.

[19] Nakai T. Naze Danjo Betsugaku ha Kodomo wo Nobasu noka [Why Students in Single-Sex Education Schools grow well?]. Tokyo: Gakken Publishing; 2010.

[20] World Economic Forum. Global Gender Gap Report 2021. World Economic Forum. 2021. Available from: https://www3.weforum.org/docs/WEF_GGGR_2021.pdf

[21] Takahashi K, Aramaki H. “Japanese Value Orientations” in a Forty Year Time-Series Survey: From the Survey on Japanese Value Orientations. NHK Broadcasting Culture Research Institute. 2016. Available from: https://www.nhk.or.jp/bunken/english/reports/pdf/report_16070601.pdf