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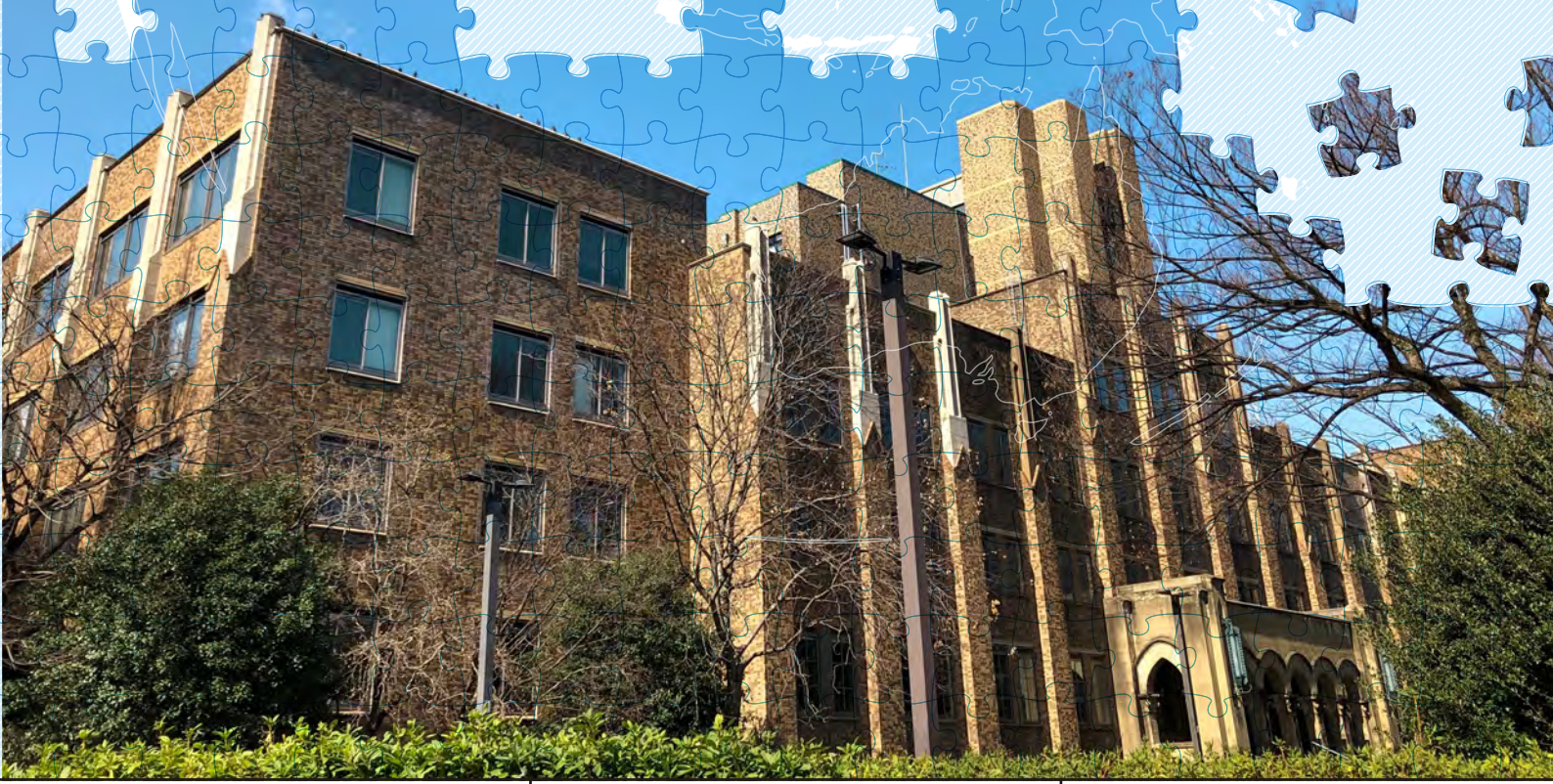
Gendered Parental Preference for College Applications: Experimental Evidence from a Gender Inegalitarian Education Context



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Abstract (172 words)
In Japan, the gender gap in attendance at four-year universities is narrowing, yet significantly fewer women apply to selective colleges. A growing body of literature suggests that parental influence is pivotal in shaping children's college choices. However, the capacity to make causal claims remains limited in existing research, as observed gendered preferences among parents may merely echo earlier educational investments made before college applications. This study advances the field by leveraging a survey experiment approach. Our conjoint experiment, where respondents evaluate hypothetical college choices of fictitious children, yields several key findings. First, parental responses show no difference when the children, regardless of their gender, opt for selective colleges. Second, the respondents who expect higher returns from college education for men than for women tend to favor their fictitious son's selective college applications. Third, fictitious daughters' college choices are rated more favorably when they conform to societal gender stereotypes. These findings underscore the potential influence of recent admissions reforms in Japanese universities, including explicit quotas for female applicants, aimed at increasing their enrollment.

Keywords: gender, higher education, horizontal stratification, parental preference, Japan

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Introduction

In many wealthy countries, women increasingly outnumber men in higher education attendance (DiPrete and Buchmann 2013). Despite rapid equalization and the so-called gender gap reversal at the *vertical* level of educational attainment, *horizontal* stratification persists in higher education. The most notable example is sex-based segregation (England 2010; England and Li 2006; Jacobs 1995; Mann and DiPrete 2003; van de Werfhorst 2017). Moreover, some studies have noted that women's underrepresentation at selective universities[1] remains prevalent in societies with relatively strong institutional differentiation in terms of academic selectivity (Bielby et al. 2014; Buchmann et al. 2010). Proposed mechanisms to explain this enduring gender segregation include differences in individual preferences and expectations that are closely tied to specific fields (Weeden et al. 2020; Williams and Ceci 2012) or culturally stereotyped beliefs that influence the perceptions of competence or suitability of men (or women) for certain educational and career trajectories (England 2010; Ridgeway 2001; Ridgeway and Correll 2004; Quadlin 2019). These cultural beliefs are significant, as they shape the perceived roles and expectations of both men and women (DiPrete and Buchmann 2013).

These combined perspectives provide a widely recognized explanation for the persistent gender segregation in higher education, but the processes through which gendered college choices are made remain underexplored. Specifically, past studies have often implicitly assumed that students, who are influenced by cultural stereotypes formed through childhood socialization processes, are the primary decision-makers in selecting a college. However, recent research indicates that parents also play an active role in their children's gendered choices of college and major (Armstrong and Hamilton 2013; Hamilton 2016; Lor 2023; Mullen 2010). Therefore, it is

[1] Throughout this paper, we discuss the selectivity of colleges based on their admission competitiveness.

critical to examine how parents' gendered attitudes toward college selection contribute to gender segregation within higher education.

In this study, we examine the influence of parental preferences within the contexts of the gender essentialist and expansive higher education system in Japan, a nation characterized by persistent gender segregation in higher education, a highly stratified institutional hierarchy, and a privatized education market. Although the gender gap in overall college enrollment in Japan is narrowing, women remain underrepresented in science, technology, engineering, and math (STEM) fields and at selective institutions. For example, according to a 2019 government white paper, only 16.2% of scientists are women, which is the lowest proportion among OECD countries (Cabinet Office 2019). Moreover, women constitute only one-fifth of the applicants to the nation's top university, the University of Tokyo, and only 25% of the seven prestigious national universities (so-called former Imperial Universities). This pattern has persisted for over two decades. Understanding the mechanisms of horizontal gender stratification is crucial not only for enhancing our theoretical knowledge of the role that parents play in the stagnant trends of gender convergence in college choice but also for addressing empirical and policy implications for gender inequality in Japan. Previous studies have consistently indicated that the underrepresentation of women in STEM and selective colleges may significantly contribute to the extensive gender inequality in the Japanese labor market, which is among the highest of wealthy countries (OECD 2017).

Our study specifically focuses on the underrepresentation of women at selective institutions. We investigate why female high school students in Japan tend to enroll in less selective institutions than their male counterparts, despite having similar academic achievements. Research that reflects the limited public spending on education has shown that parents

significantly influence the gender gap in educational attainment within this gender-inegalitarian context (Brinton 1993; Holloway 2010; Yamamoto 2016). Our study poses the following question: If parents exert considerable influence on their children's school choices in Japan, do they treat sons and daughters differently, even when their children aim for the same college and possess identical characteristics except for gender? We address this question using an experimental approach. Our findings indicate that the gender gap in selective college attendance can be attributed to differences in the expected returns from education and gendered stereotypes associated with attending selective colleges. These insights are important not only to understand the potential causes of women's underrepresentation in selective college attendance in Japan but also to examine the sources of cross-national variations in gender stratification within higher education. We also discuss the policy implications in light of recent implementations of explicit gender-based quota admissions at Japanese universities.

Theoretical and contextual backgrounds of college selection

The role of parents and their mechanisms

Parents are pivotal actors who influence students' educational trajectories. Research on educational stratification has extensively explored how parental socioeconomic status shapes children's educational attainment. These studies contend that social origins affect not only children's academic achievements but also their likelihood of advancing to higher educational levels, even among children with similar academic performance (Boudon 1974). This phenomenon is described by the compensatory advantage hypothesis (Bernardi 2014), wherein socioeconomically advantaged parents actively work to prevent their children's downward mobility (Breen and Goldthorpe 1997; Jackson 2013).

Similar dynamics are observed within the same educational levels. For example, the Effectively Maintained Inequality (EMI) hypothesis (Lucas 2001) posits that parental socioeconomic status influences how students are sorted into different fields within higher education, as privileged groups seek to preserve their advantages by pursuing qualitatively more distinguished fields than their less privileged counterparts. This has been supported by empirical studies that show that advantaged parents make substantial investments in their children's test preparation, often referred to as shadow education (e.g., Buchmann et al. 2010).

Although these studies have focused on differences in children's educational outcomes across the socioeconomic spectrum, they have paid less attention to how parents influence children's college *choices* (Grodsky and Riegle-Crumb 2010; Tungodden and Willén 2023), despite a few recognizable qualitative accounts (Armstrong and Hamilton 2013; Hamilton 2016; Lor 2023; McDonough 1997; Mullen 2010). This is very surprising, given the extensive body of research that consistently demonstrates parents' significant influence on educational attainment. An exception is found in the studies of school choice among younger children (e.g., children choosing a secondary education school), where a handful of studies that use a survey experiment approach have shown that parents have varied preferences for their children's school choices. Importantly, these preferences are influenced by parents' sociodemographic characteristics (Hailey 2022), perceptions of school quality (Haderlein 2021), and the gender of their children (Long and Conger 2013; Tungodden and Willén 2023).

The dearth of research on the role of parents in children's college choices may originate from an implicit assumption among scholars that children make independent decisions regarding college applications. However, a number of qualitative studies have revealed that parents are actively involved in their children's choices of college and majors. This involvement includes

interactions with parents that steer men and women toward specific major choices (Mullen 2010) and parents' detailed knowledge of higher education that guides children toward more academically challenging pathways (Armstrong and Hamilton 2013). Importantly, this parental influence on college and major choices is often gendered; for example, Mullen (2010: 169) reported that female students were geared toward teaching majors because their parents perceived that their "daughter was good with kids."

We can further argue that the importance of parental involvement in children's college choices varies across contexts. One source of variation is the level of public spending on higher education, which is more limited in some countries than in others. The lack of public spending often forces children to rely heavily on their parents' financial support to access higher education. The role of parents is further magnified in admission to selective fields or colleges, as parents' investment in supplementary educational activities, including sending their children to prep schools for exam retakes, is critical for success in meritocratic selection through high-stakes exams (Stevenson and Baker 1992).

In this sense, Japan serves as an illustrative case, given that public spending on education is considerably limited (Brinton 1993; Nakazawa 2016). For example, the government allocates only 2.5% of its GDP to education from the primary through post-secondary levels, which is considerably lower than the OECD average of 3.3% and ranks 32nd out of 35 countries. Specifically, for tertiary education, Japanese government expenditure is merely 0.49% of its GDP, one of the lowest among OECD countries, surpassed only by Luxemburg (OECD 2023). This limited public spending on education has fostered a widespread perception of college education as a private good (Nakazawa 2016). Importantly, household spending on higher education has been increasing, as tuition fees for both private and national universities have risen

over time (Ogawa et al. 2009; Tan et al. 2016). In this context, we can expect that parents play a more important role in influencing their children's college choices.[2]

Given the significance of parental gendered preference in college choice, what explains this behavior? In this study, we are particularly interested in two perspectives that may explain this preference. The first, which we call *the economic incentive hypothesis*, posits that parents may anticipate different returns from their sons attending a selective college than from their daughters (Heckert et al. 2002; Hogue et al. 2010; Smith and Powell 1990). A substantial body of sociology literature indicates that college students have well-informed expectations about returns on education, but these expectations are gendered. Specifically, men tend to overestimate their future earnings (Hogue et al. 2010; Smith and Powell 1990), whereas women predict lower salaries for the same roles (Briel et al. 2022; Heckert et al. 2002; Hogue et al. 2010). Although these studies have focused primarily on personal earning expectations, such gendered perceptions could also influence parental evaluations of future earnings for their children. Therefore, we hypothesize that parents expect lower returns on education for their daughters than for their sons.

The second perspective, which we call *the gender typing hypothesis*, posits that parents are more likely to steer their children toward programs or careers that align with widespread gendered beliefs and stereotypes that potentially differ by the child's gender (Jacobs et al. 2006; Snee and Devine 2014). In this framework, gender is considered a visible marker, which people use to assess who is more suitable for a given career (Ridgeway and Correll 2004). If the characteristics that represent gender stereotypes correlate with the outcome of interest (e.g.,

[2] The role of parents is likely further emphasized by the fact that the majority of college students enroll immediately after high school graduation, which characterizes a highly homogenized sequence and timing of life events (Brinton 2011).

selectivity), then men and women may be sorted into different segments of higher education not because of their traits per se but because of other characteristics correlated with these traits. This pattern is particularly relevant in Japan, where a strong gender-based division of labor prevails and where gender essentialist views remain strong relative to those in other affluent countries (Brinton and Lee 2016). In this study, we examine three aspects of such gender-based stereotypes, all of which correlate with the selectivity of colleges in the Japanese context.

Japanese higher education and gender dynamics

This section briefly reviews the Japanese higher education system and its interplay with gender. Two institutional features distinguish higher education in Japan from other contexts in terms of college admissions. First, there is a well-recognized hierarchy of institutional selectivity among Japanese universities (Yonezawa et al. 2002). On average, national and public universities, which account for approximately 20% of student enrollment, are perceived as more selective and generally offer a superior education. In contrast, with a few notable exceptions, private universities, which account for approximately 80% of student enrollment, are considered less selective and less prestigious (Ishida 1998; Ono 2008).[3] Second, the majority of applicants decide on their fields of study before enrolling in college, as admission is typically managed by each university department (Roth 2019). Therefore, students choose their major or concentration upon entering college, and transfers between departments are rare (Itō and Hoshi 2020).

[3] Unlike the higher education system in the United States or elsewhere, higher tuition does not necessarily indicate better education quality in Japan. Although tuition at private universities is generally higher than that at national and public universities, this is primarily due to the limited funding support from the government. For example, according to the School Basic Survey, a census of all educational institutions in Japan, the teacher-student ratio stands at approximately 1:9 for national universities and 1:11 for public universities compared with 1:20 for private universities.

Research indicates that parental financial support aimed at securing admission to selective colleges, particularly the most selective ones, is crucial in Japan. This need arises not only from the considerably limited public spending on higher education but also because supplementary educational activities (shadow education) are widespread (Hannum et al. 2019; Raymo et al. 2023). The role of parents is particularly pronounced in gaining admission to selective universities, as their investment in shadow education, including sending their children to prep schools for exam retakes, is critical for success in the meritocratic selection process facilitated by high-stakes exams (Stevenson and Baker 1992).

Access to higher education in Japan presents notable gender disparities. Historically, a majority of women in higher education have attended junior colleges; for example, in the 1980s, almost 90% of female students were enrolled in these institutions (MEXT 2023). This gendered pattern began to change with the introduction of gender equality policies around the 1990s, which significantly improved women's occupational opportunities (Edwards and Pasquale 2003). Reflecting these macrolevel social changes, women have increasingly narrowed the gap with men in terms of bachelor's degree attainment. Panel A of Figure 1 shows the gender-specific trends in tertiary education enrollment. Although the university attendance rate for women is still slightly lower than that for men, the gender gap in four-year university attendance has decreased to 5 percentage point.

Despite this converging trend, the educational trajectories of men and women within four-year institutions continue to diverge. First, as observed in Western countries, significant gender segregation in fields of study persists and has stalled in recent years (Nakao 2022; Uchikoshi et al. 2020). For example, considerably fewer female tertiary graduates in Japan choose STEM fields than their counterparts in other economically rich countries (OECD 2017).

Second, a notable gender gap in attendance at selective colleges also remains. Panel B of Figure 1 presents the share of female enrollment in four-year universities by institution type and selectivity, according to a classification scheme developed by Kaneko (1996) and Toyonaga (2022). This scheme categorizes universities into five types: "Selective National and Public," "Other National and Public," "Selective Private," "Moderately Selective Private," and "Non-selective Private." A detailed description of this classification scheme can be found in Supplementary Material A. The data show that although the overall gender gap in attendance has decreased, this reduction is primarily due to increased female attendance at private universities, where women now constitute 47% of enrollments, achieving near parity. In contrast, women are underrepresented at national and public universities and make up only 43% of enrollments at these institutions, which are considered more selective than private universities (Ishida 1998; Ono 2008). Furthermore, the share of female enrollment is even lower at selective national and public universities, where only 36% of students are women. These patterns have remained consistent for nearly two decades.

[Figure 1 about here]

Do parents play any role in shaping these gendered college enrollment patterns? We discuss two perspectives that may explain parental gendered preferences for college, both of which are relevant to the Japanese context. On the one hand, there is substantial reason to expect that parents hold lower expected returns for daughters than for sons in terms of attending selective colleges. In Japan, graduates from selective colleges often secure positions at large firms (Hirasawa 2010; Ishida 1998; Yoshida 2020), which are known for demanding work

conditions, including long hours and frequent relocations (JILPT 2016; MHLW 2022). Such conditions can deter continued employment after marriage and childbirth, which may influence parental expectations. This view is supported by studies suggesting that parents still maintain lower educational expectations for their daughters than for their sons (Holloway 2010; Lee 2010; Ojima and Aramaki 2018; Yamamoto 2016), despite a convergence in children's educational aspirations (Ojima and Aramaki 2018).

On the other hand, another compelling but not competing perspective posits that cultural stereotypes about gender play a role in parental preferences for college choices. Extensive literature indicates that societal views on gender attribute different capabilities to men and women, with women often stereotyped as social, nurturing, or expressive and men stereotyped as analytical (Ridgeway and Correll 2004). Drawing from existing studies, we focus on three school characteristics (fields of study, gender composition, and geographical proximity) through which these stereotypes have implications for the underrepresentation of women at selective colleges. First, studies have shown that these gendered stereotypes are used to assess who fits better in a certain educational or occupational choice (e.g., Charles and Bradley 2009; England 2010). In this context, STEM majors and mathematically intense fields such as economics are regarded as male-typical, while fields that require social and nurturing skills, such as education, health care, or humanities, are seen as female-typical. Existing studies using Japanese samples have also shown that these stereotypes lead to gender-associated assumptions about suitable fields of study (Froehlich et al. 2022; Ikkatai et al. 2020). For example, Ikkatai et al. (2020) reported that certain majors, including nursing, pharmacy, and humanities, are perceived as more suitable for female students, whereas engineering and physics are viewed as least suitable for women.

Second, since gender is used as a status characteristic that allocates men and women into different trajectories, school gender composition can be a strong signal that motivates cultural stereotypes expressed in parents' school preferences. Previous studies have shown that parents often consider the racial composition of schools when making choices, with a preference for schools with a predominantly same-race student body (Hailey 2022). This preference could be driven by affective closeness to the in-group or by cultural stereotypes about specific demographic subgroups. In the UK, studies have shown that parents of daughters exhibit a stronger preference for single-sex education than parents of sons (Jackson and Bisset 2005; Noden et al. 1998; Robinson and Smithers 1999). Although research on parental preferences for school gender composition in Japan is limited, the relatively stable number of single-female high schools compared with single-male schools (see MEXT 2023) suggests that parents may be particularly sensitive to the gender composition of schools if their child is female.

Finally, another less emphasized but critical dimension influenced by gender-based stereotypes is geographical proximity (David et al. 2003; Lor 2023; McDonough 1997). Numerous studies have shown that parents have different relationships with sons and daughters. Specifically, daughters often provide more emotional support to their parents and thereby maintain a closer relationship with them (Fingerman et al. 2020; Lei 2013). Reflecting these gender differences in parent-child relationships, older parents prefer their daughters rather than their sons to live nearby (Silverstein and Angelelli 1998). In East Asia, this emotional bond with daughters is further emphasized, as parents expect daughters to provide future care. This emerging trend toward a daughter preference in South Korea or Japan supports this view (Chun and Das Gupta 2009; Chun and Das Gupta 2022; Fuse 2013), with scholars suggesting that parents who foresee future care needs prefer their daughters to live close (Ishikawa 2009; Okuda

2022). Consequently, this parental preference for daughters' proximity is likely influenced by gendered stereotypes about women's roles in caregiving.

Importantly, these attributes vary across the spectrum of college selectivity in Japan. Selective (particularly national) universities, which are more likely to offer STEM majors, are predominantly located in urban areas and tend to be male-dominated. Therefore, if these gender stereotype explanations hold true, then the underrepresentation of women in selective colleges may not result solely from gender differences in expected returns on selectivity. Instead, it could be attributed to institutional characteristics associated with selectivity that influence parental decisions on which colleges they encourage their daughters to aim for and attend.

Empirical hypotheses

In this study, our goal is to identify the sources of parental gendered preferences for college choices. To address this question, we first test whether sons and daughters are treated differently when they aim for selective colleges. We hypothesize that people are less likely to encourage their daughters, as opposed to their sons, to aim for selective colleges. This expectation originates from two theoretical frameworks: the economic incentive hypothesis, which posits a perceived gender difference in the expected returns from attending a selective college, and the gender typing hypothesis, which suggests that selective colleges are viewed as more male-typical.

Hypothesis 1: All else being equal, parents are less likely to encourage their daughters than their sons to aim for a selective college.

Second, we examine two potential mechanisms by assessing the hypothesis that the respondents will react to characteristics correlated with selectivity rather than selectivity itself. We first test the gender typing hypothesis. If this hypothesis holds true, then parents' encouragement of their children to aim for a college may differ based on the gender of their child, potentially contributing to the gender gap in applications to selective colleges if selectivity correlates with gender-stereotyped characteristics. Specifically, we propose the following three hypotheses:

Hypothesis 2a: All else being equal, people are more likely to encourage their daughters than their sons to aim for a college with a higher proportion of female students.

Hypothesis 2b: All else being equal, people are more likely to encourage their daughters than their sons to aim for a college to which they can commute from home.

Hypothesis 2c: All else being equal, people are more likely to encourage their daughters than their sons to aim for a major that is female-dominant and non-STEM.

These hypotheses posit that people respond uniformly to the characteristics of educational institutions. Additionally, we explore a set of hypotheses regarding differential responses based on the parents' characteristics. First, under the economic incentive hypothesis, we expect the hypothesized gender gap in encouraging the application to selective colleges to be wider among those who perceive a greater gender difference in the economic returns from college attendance. Second, according to the gender-typing hypothesis, this gender gap is expected to be more pronounced among those who endorse gender essentialist norms.

Hypothesis 3a: The hypothesized gender gap when encouraging the application to selective colleges is greater among those who expect a greater gender difference in expected returns from college attendance.

Hypothesis 3b: The hypothesized gender gap when encouraging the application to selective colleges is greater among those who endorse gender essentialist norms.

Research design

Survey experiment approach

One of the critical challenges in identifying parental gendered preferences for college choice and its underlying mechanism is the multidimensional nature of school choice criteria in establishing causality. The most straightforward approach is to analyze observational data that reveal whether parents' expectations about college education or gendered stereotypes are correlated with their children's college choices. However, parents often refer to more than one characteristic in the school choice process. Moreover, as previously mentioned, these traits are often bundled together, which makes it difficult to estimate in the observational data the causal effects of single traits on the college application process. Additionally, the causal effects of parental preference on children's college choices are potentially obscured in such data by unobserved confounders. For example, parents may have lower educational expectations for daughters than for sons. However, these differences could reflect disparities in the educational investments made prior to the gathering of data on parental expectations, which might not be captured in survey data. Thus, it remains unclear whether parents respond differently to children aiming for the same college based on the child's gender. Moreover, respondents often provide

answers that align with socially desirable norms, which further complicates the accurate identification of parental gendered preferences for college choices.

To address these issues, we adopt an experimental approach that allows us to control for potential confounders and mitigate social desirability bias. In this study, we conducted an online survey featuring a randomized conjoint experiment (Hainmueller et al. 2014) to explore the mechanisms behind gendered expectations regarding selective college attendance. A conjoint experiment is a compelling method to eliminate social desirability bias and estimate respondents' multidimensional preferences (Horiuchi et al. 2022). In this experiment, the respondents are exposed to profiles that depict a fictitious son or daughter who is a high school senior aspiring to attend college. The respondents are presented with the following prompt: "Suppose you have a [son/daughter] who is a high school senior. He/she wants to attend a four-year university and is preparing for the nationwide entrance exam with the following university as their first choice. Please read their profile carefully and answer the following questions." The child's gender is randomly assigned at the respondent level; each respondent consistently evaluates either a son or a daughter across all 15 scenarios. After viewing each profile, the respondents are asked to rate the likelihood of recommending the child to apply to the college on a 6-point scale, where higher values indicate a stronger recommendation. Each respondent completes this rating task 15 times and evaluates one profile per task.[4] For the experimental attributes in each profile, which we discuss in detail later, we manipulate various characteristics of the colleges targeted by the students and certain traits of the students themselves.

[4] There is a concern that asking respondents to complete numerous conjoint tasks might affect the quality of their responses. However, studies have found that the number of tasks does not influence response quality, at least up to 30 repetitions (Bansak et al. 2018).

The survey was conducted from February 24 to March 1, 2023.[5] We distributed the survey questionnaire to online panels registered with Rakuten Insight, Inc., which is one of the largest Japanese online survey companies. We set sampling quotas based on three demographic variables (respondents' gender, area of residence, and age) to ensure that the sample is representative of the target population, which is Japanese adults aged 20–79 years.[6] The pre-registered sample size was 3,000 subjects, and any data collected beyond this number were discarded. The wording of the questions in the original Japanese and English translations are available in Supplementary Material C, while the respondent-level summary statistics are provided in Supplementary Material D.

Variables

Our manipulated variables consist of hypothetical profiles of children who are high school seniors and their first-choice college. We manipulate the following eight traits: (1) institution type and tuition, (2) department, (3) selectivity, (4) share of female students, (5) student/faculty ratio, (6) job placement rate, (7) whether the student can commute from home, and (8) the student's chance of admission.[7] Four traits (2, 3, 4, and 7) are directly related to our hypotheses. Three traits (1, 5, and 6) are criteria often referred to by college applicants when choosing a school, so we include these traits to make the experiment realistic. The last trait

[5] This study was approved by the institutional review board of Waseda University. We preregistered our hypotheses and analysis methods on the Open Science Framework (https://osf.io/64e2v). Notably, our pre-registration includes other hypotheses not tested in this paper. We focus on the economic incentive hypothesis and the gender typing hypothesis in this paper. The other hypotheses will be considered in future studies.

[6] In the survey, we ask the respondents to provide their date of birth, gender, and area of residence. We then compare the distribution of these self-reported demographic characteristics with the distribution of characteristics collected by Rakuten Insight, Inc., one of the largest Japanese online survey companies, which is used to establish the quota. This comparison is shown in Supplementary Material B.

[7] Similar to concerns about the number of tasks, there is a concern that showing too many attributes in conjoint profiles might influence the response quality. However, studies have shown that even when the number of attributes increases to 35, survey satisfaction does not significantly compromise the findings (Bansak et al. 2021).

(student's chance of admission) is not a school characteristic; however, we include this trait because, similar to the three traits mentioned above, the respondent's recommendation is likely to be sensitive to the student's chance of admission. The levels for each dimension are shown in Table 1.[8] Among these eight dimensions, we are particularly interested in the selectivity, department, share of female students, and feasibility of commuting from home as the key independent variables. In Japan, college selectivity is often measured by the standardized rank score (*hensachi,* deviation score) provided by testing services. This measure is constructed by calculating a standard deviation from the average of applicants' test scores. *Hensachi* for a given college is higher when more high-performing students apply. Testing services simplify the score by multiplying it by 10 and adding 50, adjusting it to a mean of 50 and a standard deviation of 10. Based on the national score distribution, we define colleges with a *hensachi* score of 62.5 (equivalent to +1.25 SD) as selective colleges. Department options include economics, engineering, humanities, pharmacy, and education. We categorize the first two departments as male-typical fields and the latter three as female-typical fields according to the earlier cited studies on gender stereotypes.

The dependent variable is the respondent's rating, a measure of the respondent's recommendation for a specific fictitious child to apply to a college, scored on a 6-point scale ranging from "do not recommend at all" to "strongly recommend." The key moderating variable across all hypotheses is the gender of the fictitious child.

To test Hypotheses 3a and 3b, we also utilize variables that capture the respondents' expected gender differences in economic returns from college and their adherence to gender

[8] To enhance the external validity of our study, we adjust the assignment probability of the attributes to match their real-world distributions where available (de la Cuesta et al. 2022); for attributes without available distributions, we use a uniform distribution. Further discussion and details on the assignment probabilities can be found in Supplementary Material E.

essentialist beliefs. These variables are measured before the experimental component to avoid post-treatment bias. To construct the variable for expected economic returns, we first ask the respondents to estimate the difference in economic returns between attending university and starting work immediately after high school. This involves calculating the earnings after university graduation minus the earnings that they would have received if they had started working after high school graduation, along with all associated college costs (e.g., tuition and living expenses). We then ask respondents to assess the likelihood that university graduates, both men and women, would achieve the same economic returns as high school graduates within five years of graduation. The gap between men's and women's expected returns forms the constructed variable. For example, if the respondents believe that male university graduates have a 100% chance of achieving at least the same earnings as high school graduates within five years and that female university graduates have a 0% chance, then the variable value is 100. Conversely, if they assign a 100% chance to female university graduates and a 0% chance to male graduates, then the value is −100. The variable for gender essentialist beliefs is a composite measure created by averaging the responses to six questions that gauge the respondents' gender-related attitudes, with higher values indicating a stronger endorsement of gender-essentialist ideas. These questions are listed in Supplementary Material C. This variable is standardized such that the mean is 0, and the standard deviation is 1.[9]

Statistical inference

[9] For the supplementary analyses, we examine whether the estimated results exhibit heterogeneity based on the pre-treatment characteristics of the respondents. We specifically test heterogeneity with the following traits: respondent's gender, age, region (urban versus rural), marital status (never married, divorced, and widowed), household composition (number, sex, and age of children), and risk preference. The results of these analyses are reported in Supplementary Material I.

Before testing our hypotheses, we review the results by estimating the marginal means (MMs, Leeper et al. 2020) for each attribute related to the fictitious sons and daughters. We then employ a linear regression to test our hypotheses. For Hypotheses 1, 2a, 2b, and 2c, our quantity of interest is the average marginal component effects (AMCEs) of the relevant attributes, conditioned by the fictitious child's gender. An AMCE represents the effect of a level of a single attribute relative to its reference level, computed by marginalizing its effect conditioned by all other attributes (Hainmueller et al. 2014). For the remaining hypotheses, we focus on the effect of the fictitious child's gender when the child aims for a selective college (i.e., *hensachi* = 62.5). We consider *p* values less than 0.05 to be statistically significant for our inference criteria.

We denote y_{ij} as the dependent variable for respondent *i*'s *j*-th task, x_{ijkl} as a dummy variable indicating attribute *k*'s *l*-th level of respondent *i*'s *j*-th task, and z_i as a dummy variable indicating that a fictitious child is a daughter (we introduce other respondent-level variables on a case-by-case basis). *k* and *l* correspond to the order of attributes and levels shown in the "*Manipulated variables*" section above. For example, x_{ij35} represents a dummy variable indicating attribute 3's (= selectivity) 5th level (= 62.5) of respondent *i*'s *j*-th task. We also identify α as an intercept, β_{kl} as the coefficient of x_{ijkl}, and ε_{ij} as an error term (we introduce other parameters on a case-by-case basis). The parameters in the linear regression are estimated using ordinary least squares, with CR2 standard errors clustered by the respondent.

To test Hypothesis 1, we examine whether the AMCE of the selectivity score is greater for daughters than for sons.[10] We thus estimate the following linear model:

$$y_{ij} = \alpha + \sum_{kl}\beta_{kl}x_{ijkl} + \gamma z_i + \delta_1 x_{ij31} z_i + \delta_2 x_{ij32} z_i + \delta_3 x_{ij34} z_i + \delta_4 x_{ij35} z_i + \varepsilon_{ij} \text{ ..... (1).}$$

[10] We changed the analytical method originally intended to test Hypothesis 1, as outlined in our pre-analysis plan, after recognizing that the pre-registered method led to misleading interpretations. We provide a detailed explanation of this change in Supplementary Material F.

We set the selectivity score of 50 (i.e., a college of average selectivity) as a reference category.[11] $-\beta_{35}$ indicates the AMCE of the selectivity score of 62.5 ($k = 3$, $l = 5$) compared with 50 for sons. $-\beta_{35} - \delta_4$ is the AMCE of the selectivity score for daughters. Hypothesis 1 expects δ_4 to be negative.

To test Hypothesis 2a, we examine whether the AMCE of the share of female students is greater for daughters than for sons. We therefore estimate the following linear model:

$$y_{ij} = \alpha + \sum_{kl}\beta_{kl}x_{ijkl} + \gamma z_i + \delta_1 x_{ij41} z_i + \delta_2 x_{ij42} z_i + \delta_3 x_{ij43} z_i + \varepsilon_{ij} \text{ ..... (2).}$$

$-\beta_{41}$ indicates the AMCE of the female student share ($k = 4$), namely, 79%, compared to 16% ($l = 1$) for sons, $-\beta_{42}$ represents an AMCE of 79% compared to 35% ($l = 2$) for sons, and $-\beta_{43}$ denotes an AMCE of 79% compared to 54% ($l = 3$) for sons. $-\beta_{41} - \delta_1$, $-\beta_{42} - \delta_2$, and $-\beta_{43} - \delta_3$ are the AMCE for daughters. Hypothesis 2a expects δ_1, δ_2, and δ_3 to be negative.

To test Hypothesis 2b, we examine whether the AMCE of the commutability from home is greater for daughters than for sons. Accordingly, we estimate the following linear model:

$$y_{ij} = \alpha + \sum_{kl}\beta_{kl}x_{ijkl} + \gamma z_i + \delta x_{ij71} z_i + \varepsilon_{ij} \text{ ..... (3).}$$

β_{71} indicates the AMCE of the commutability from home ($k = 7$) being possible ($l = 1$) for sons, and $\beta_{71} + \delta$ is this AMCE for daughters. Hypothesis 2b expects that δ is positive.

To test Hypothesis 2c, we examine whether the AMCEs of female-dominant non-STEM college majors are greater for daughters than for sons. First, we compare the MMs of each major between sons and daughters. For a formal test of the hypothesis, we recategorize college majors and redefine x_{ij21} as a dummy variable indicating that the college major is humanities, pharmacy, or education for respondent i's j-th task, which makes the analysis simpler. We therefore estimate the following linear model:

[11] Thus, the term corresponding to the selectivity score of 50 is excluded from the summation of $\beta_{kl}x_{ijkl}$. This applies to the other attributes and models hereafter.

$$y_{ij} = \alpha + \sum_{kl}\beta_{kl}x_{ijkl} + \gamma z_i + \delta x_{ij21}z_i + \varepsilon_{ij} \text{ ..... (4).}$$

β_{21} indicates the AMCE of female-dominant college majors for sons, and $\beta_{21} + \delta$ is that for daughters. Hypothesis 2c expects δ to be positive.[12]

To test Hypothesis 3a, we examine whether the gender difference in the MM with a selectivity score of 62.5 is larger for those who expect a greater gender disparity in economic returns from college attendance. Here, w_i represents the expected gender difference in economic returns from college attendance for respondent i. We estimate the following linear model via observations such that $x_{ij35} = 1$:

$$y_{ij} = \alpha + \gamma z_i + \delta w_i + \zeta z_i w_i + \varepsilon_{ij} \text{..... (5).}$$

Hypothesis 3a expects that ζ is negative.

To test Hypothesis 3b, we examine whether the gender difference in the MM with a selectivity score of 62.5 is larger for respondents with a high gender-essentialist-idea score. Here, w_i represents respondent i's gender-essentialist-idea score. We estimate the following linear model using observations such that $x_{ij35} = 1$:

$$y_{ij} = \alpha + \gamma z_i + \delta w_i + \zeta z_i w_i + \varepsilon_{ij} \text{ ..... (6).}$$

Hypothesis 3b expects that ζ is negative.

Results

Descriptive results

[12] In the pre-analysis plan, we stated that we would examine the robustness of our results by changing the base category in the regression model, given the susceptibility of the conditional AMCE to the choice of base category for attributes with more than two levels (Leeper et al. 2020). However, upon further reflection, we adjusted our approach to more closely align with the focus of our hypotheses. We opted to conduct statistical tests to detect the average marginal interaction effects (Egami and Imai 2019) as an alternative approach for the robustness checks. This adjustment reaffirmed our conclusions. A detailed discussion and the results are shown in Supplementary Material H.

Figure 2 shows the MMs of each attribute level for the fictitious sons and daughters. Since the differences in the relative influence of each attribute level are not immediately apparent from the illustration of the raw MMs, we depict these MMs centered by the respective grand mean for sons and daughters.[13] For both sons and daughters, the ratings submitted by the respondents vary across all attribute levels. For example, the respondents generally give higher approval ratings to national and public universities than to private universities, aligning with the widespread belief among the public that non-private institutions provide quality education. Similarly, when other factors are held constant, the respondents give higher approval ratings when their fictitious children aim for selective colleges. Regarding admission probabilities, higher approval ratings correspond to higher chances of admission. Notably, pharmacy programs receive higher approval ratings than other fields of study. There is also a marked preference for colleges where children can commute from home.

The results also highlight important gender differences. On average, programs in education, pharmacy, and humanities are rated more favorably when the child aiming for these programs is female rather than male. Furthermore, colleges with a female majority student body receive higher approval ratings when the child is female. In terms of admission chances, higher ratings are given when the chance of admission is 50% and the child is female. For the other attributes, major gender differences are not observed.[14]

[Figure 2 about here]

[13] We show a figure using non-centered MMs in Supplementary Material G.
[14] Another notable difference related to the child's gender is that daughters are generally more likely to be encouraged to apply to college, irrespective of attributes; that is, the non-centered MMs for most attribute levels are higher for daughters than for sons. However, this finding cannot be interpreted as indicative of a general preference among Japanese people for daughters' pursuit of higher education because the overall average of the ratings is highly contingent on the attribute levels included in the conjoint design. For more specific details, see Footnote 15.

Regression results

Table 1 presents the regression results from testing Hypotheses 1, 2a, 2b, and 2c. Model (1) corresponds to the equation described in the methods section, where the coefficients of the first-order terms indicate the conditional AMCE for sons. These coefficients clearly suggest that the respondents recommend higher selective colleges more frequently for fictitious sons. However, this is also the case for daughters, as illustrated in Figure 1. The coefficient of the interaction term between the dummy for the selectivity score of 62.5 and the daughter dummy is close to zero and not statistically significant. This result contradicts Hypothesis 1, which posits that the respondents are more likely to discourage fictitious daughters from aiming for such colleges.

Model (2) explores the differences in approval ratings when fictitious daughters aim for colleges with a higher percentage of female students. For sons, the female share of the college does not significantly influence the approval rates. Compared with the reference group, only the gender ratio of 35:65 significantly increases approval (21:79). The interaction coefficients, which indicate the differences in the conditional AMCEs between sons and daughters, show that the respondents rate options less favorably for daughters aiming for schools with fewer women, except for the level of 54:46. These coefficients are significantly negative, and they align largely with Hypothesis 2a, which expects a parental preference for schools with more students of the same gender as their child. The calculated conditional AMCEs for daughters reveal a statistically significant 0.12-point lower rating for a college with only 16% of women than for a college with a majority (79%) of female students, whereas the effects for the other ratios are not statistically significant.

Model (3) tests for the interactions between the fictitious child's gender and the distance to college from home. Consistent with the observations in Figure 1, the respondents rate colleges that are commutable from home more favorably. Contrary to our expectations, however, the preference for proximity does not significantly differ between genders; the ratings for commutable colleges are similarly favorable for both sons and daughters (0.40 and 0.42 points, respectively), with a negligible and non-significant difference of 0.02 points.

Model (4) examines whether the respondents are more encouraging toward fictitious daughters aiming for female-typical programs such as humanities, pharmacy, and education. There is a clear difference in the respondents' ratings based on the child's gender. The coefficient for female-typical programs is not statistically significant, suggesting that the respondents react similarly to male- and female-typical majors if the child is a son. In contrast, the respondents' ratings significantly increase by 0.07 (= 0.11 + 0.03) points if the child is a daughter. The difference in the conditional AMCEs is statistically significant and supports Hypothesis 2c.[15]

[Table 1 about here]

In Table 2, we test Hypotheses 3a and 3b, which posit that the respondents do not necessarily encourage fictitious female children to aim for highly selective colleges if they

[15] These results explain why the respondents assign relatively higher ratings for female children (see Footnote 14). This outcome is largely influenced by our experimental design in which female-typical programs (the number of levels is three, and the assignment probability is 60%) are more prevalent than male-typical programs (the number of levels is two, and the assignment probability is 40%). Additionally, the respondents tend to favor female children aiming for programs that are considered female-typical. Consequently, the grand means for sons and daughters should not be interpreted as reflecting a general preference among Japanese people for encouraging daughters to pursue higher education. If we had used a different distribution of the department attribute, then the grand means for sons and daughters could have been reversed.

perceive lower expected returns from college for women or hold gender essentialist beliefs. For this analysis, we again limit our sample to cases where the fictitious children target the most selective colleges. The results from Model (5) reveal that the gender gap in expected returns significantly influences the approval ratings for the college applications of the fictitious sons and daughters. For the fictitious sons, a 10% increase in the gender gap in expected returns correlates with a 0.04-point increase in the approval rating. In contrast, for the fictitious daughters, a similar increase in the gender gap results in a 0.02-point decrease (= 0.04 – 0.06) in the approval rating, but this decrease is not statistically significant. The difference in the effect of this variable between sons and daughters is 0.06 points, which is statistically significant.

Model (6) examines the heterogeneous response patterns driven by gender essentialist beliefs. The interaction coefficient between essentialist beliefs and the daughter dummy variable is –0.09 and statistically significant, indicating that a one-standard deviation increase in gender essentialist beliefs results in a 0.07-point decrease in the respondents' approval ratings for female children targeting selective colleges compared with male children. These results support Hypotheses 3a and 3b.

[Table 2 about here]

Discussion

Despite robust evidence that parents play a critical role in their children's college applications, few studies have quantitatively examined this influence. This gap is partly due to the challenges in causal identification. Parental preferences for their children's college choices are shaped by a range of pre-treatment variables, including the children's academic

achievements, field-specific orientations, occupational aspirations, and attitudes toward work and family, all of which are also influenced by parental characteristics.

To address these causal identification challenges, we leveraged a survey experiment approach and tested whether individuals respond differently to their fictitious children's college choices based on whether their child is a son or a daughter. We focused on the case of selective college applications in Japan, a context where relatively few women apply to selective colleges despite a convergence in the overall gender gaps in higher education attendance. The results from the conjoint experiment reveal several key findings. First, the respondents do not necessarily discourage fictitious daughters from aiming for highly selective colleges, which suggests that there is no explicit discouragement of female children from such ambitions. Second, however, other results indicate that discouragement might occur because parents possess gender-differentiated preferences for traits that are correlated with college selectivity in the real world, which were manipulated independently in our survey experiment. Specifically, we find that the respondents rate female children's college applications more favorably if they target female-dominated colleges or fields typically associated with women, such as humanities, education, and pharmacy. These findings are consistent with the gender-typing hypothesis, which posits that parents prefer daughters to aim for colleges that align with societal gender stereotypes. Since selective colleges, especially selective national universities, tend to have fewer women and offer more male-typical programs, such as engineering (Uchikoshi et al. 2020), individuals may respond based on these characteristics.[16] As a result, fewer women than men

[16] For example, more than half of the students at private universities major in humanities or social sciences, compared to only 22% at national universities (Uchikoshi et al. 2020). This disparity is attributed to the higher levels of government funding received by national and public universities, which allow them to offer a broader range of fields, including STEM. In contrast, private institutions, which receive less funding, predominantly offer non-STEM fields that require less financial investment to establish.

may apply to selective colleges. The gender-typing hypothesis is further supported by the results that examine the respondents' heterogeneous responses based on their gender essentialist beliefs. We find that individuals with less gender essentialist attitudes are more likely to discourage their fictitious daughters from aiming high than their counterparts are. Since these traits shape respondents' gendered response to the college choice *net of* college selectivity, these results suggest that changing the female share or the composition of fields of study may have implications for parental preferences for children's college choices, which provides our unique contribution through the use of a survey experiment approach.

Our results support the gender-typing hypothesis. We also find that the respondents' gendered expectations regarding the returns on college education are associated with their different reactions to their children's college choices by gender. Specifically, those who expect greater returns from college for men than for women are more likely to encourage their fictitious sons to aim for selective colleges. These findings suggest that individuals may not have an explicit preference for men's or women's selective college attendance, but they exhibit these preferences if they believe that college education yields higher returns for men. Importantly, individuals' estimates of college returns for men and women may not always be accurate. If people hold more gender-biased estimates, then this could lead to gendered encouragement by parents for selective college applications. The evidence suggests that the returns on college education likely differ for men and women in Japan, primarily because of the well-established pattern of women experiencing career interruptions related to family events. Recent evidence indicates that college-educated women in Japan are increasingly continuing their employment after childbearing (Mugiyama 2024). Given that parents may base their estimates of college returns on their own experiences, intervening to correct parents' potentially biased perceptions

about college returns for men and women could help mitigate the gender gap in selective college attendance.

Our analysis has several limitations. The most critical limitation is the hypothetical nature of our setting. Although every survey experiment involves hypothetical scenarios, our study specifically asks the respondents to assume the role of a fictitious parent. This setup may mean that our results reflect individual tastes regarding which colleges are considered more desirable rather than actual parental behavior. We cannot test whether the respondents' answers would change if they were asked to rate the application as a stranger or if they were asked to remain fictitious parents. Nevertheless, we believe that this study provides suggestive but important evidence for potentially differential responses by parents based on the gender of their child and individual characteristics. Moreover, it is crucial to emphasize that our research design utilizing a survey experiment approach, despite its hypothetical scenario, reveals that the traits correlated with the selectivity of colleges in the real world (e.g., female share) influence parental preferences for college choices more than selectivity per se; this represents our key contribution to the literature on the gender gap in selective college attendance.

Another limitation is that, even if our results reflect parents' preferences, the extent to which these stated preferences at the time of college application influence the gender gap in college outcomes remains an empirical question. We are aware that men and women are allocated into different segments of education at much earlier stages. Existing evidence suggests that parents, despite recent changes in trends, have historically held lower educational expectations for daughters than for sons, tend to associate female children with non-STEM subjects, and invest more in shadow education for sons. It is possible that gender segregation and inequality in education are substantial even before children apply to college. However, based on

existing evidence, we still assert that parents play an important role in college applications, especially in contexts where public spending on education is extremely limited.

Despite these limitations, this study has important theoretical, methodological, and policy implications. First, theoretically, it provides evidence that is consistent with earlier studies on mechanisms of educational inequality, which have shown that providing correct information about the returns on education increases college enrollment intentions among socioeconomically disadvantaged children (Ehlert et al. 2017; Peter and Zambre 2017). Gender also plays a crucial role in perpetuating segregation in higher education. Although recent studies offer mixed evidence regarding whether information on the economic benefits of different fields of study can alter gender gaps in intended college major selection (Barone et al. 2019; Finger et al. 2022; Peter et al. 2024), our findings suggest that addressing parents' biased gendered expectations about economic outcomes may help reduce the gender gap in selective college attendance.

Second, methodologically, we believe that our survey experiment approach provides compelling evidence that enhances our understanding of the sources of gender segregation in education. Specifically, the conjoint survey experiment design allows us to isolate the causal impacts of multidimensional school characteristics that are often bundled together. Our analysis reveals that the gender gap in selective college attendance is not merely a product of selectivity per se but is largely influenced by attributes associated with selectivity that reinforce gendered stereotypes and beliefs.

Third, in terms of policy, this study sheds light on the factors that contribute to the gender gap in selective college attendance in Japan. In particular, our evidence, which supports the gender-typing hypothesis, has significant policy implications. In response to the stalled progress toward gender parity, some selective colleges have initiated gender-based quota admissions

(Yokoyama et al. 2024). For example, the Tokyo Institute of Technology, a selective STEM-focused institution, has historically struggled to recruit female applicants. Recently, they reformed their admission policies to reserve a specific number of slots exclusively for female applicants. This change has enabled the school to increase female enrollment, starting with 58 females admitted in 2024 that has grown to 149, which represents approximately 15% of all student enrollments. Importantly, the Tokyo Institute of Technology is not alone; as of 2024, 5% of all universities in Japan (40 out of 800), which are primarily STEM-focused institutions, have implemented or plan to introduce this female quota admission (Asahi Shimbun 2024). Not surprisingly, this policy shift has sparked considerable debate over diversity, inclusion, and the fairness of admissions (Japan Times 2024) and has been a subject of academic scrutiny (e.g., Yokoyama et al. 2024).

In this context, it is essential to assess the potential impact of the new admission policy. Although our study relies on a survey experiment that leverages a hypothetical situation, our findings suggest that the quota policy may significantly influence future student enrollment. Specifically, our results reveal that the respondents generally exhibit more favorable attitudes toward fictitious female children's college applications when a higher number of female students are enrolled. This trend holds for both general and selective institutions. Moreover, we also observe that the respondents tend to view fictitious female children's college applications more negatively if they target STEM programs. These findings suggest that STEM-focused universities could mitigate their recruitment challenges by increasing female enrollment. The implementation of a gender-based quota system is an effective strategy for diversifying the student body.

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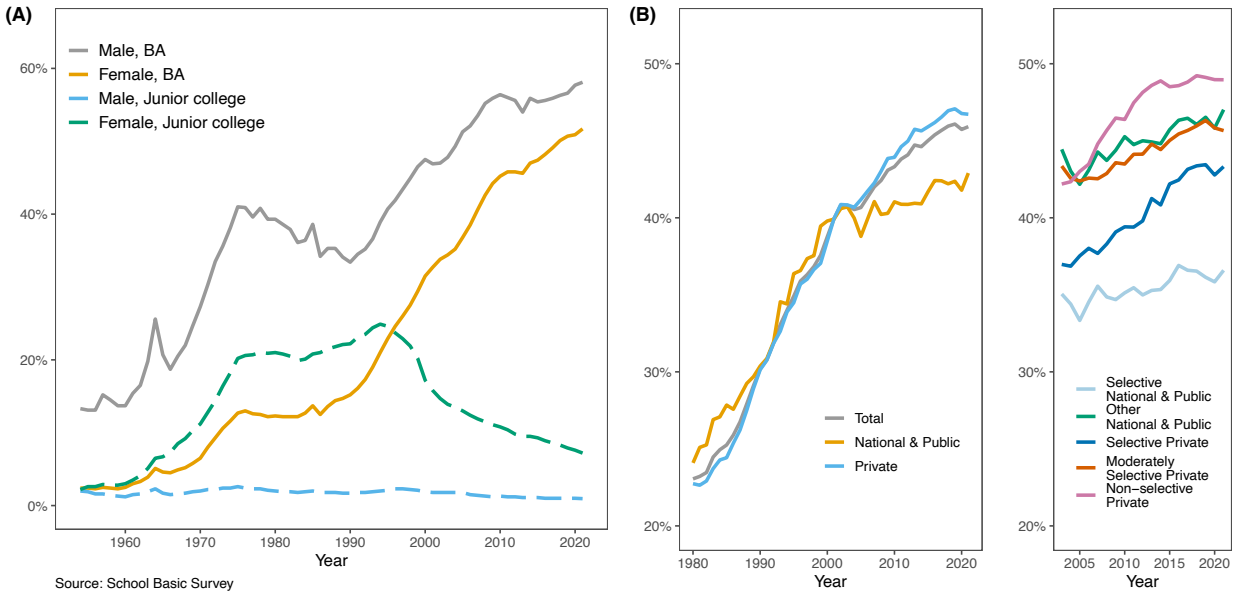

Figure 1 Trends in gender-specific attendance rates (Panel A) and the share of female enrollment by institution type and selectivity (Panel B)

Source: Uchikoshi et al. (2024)

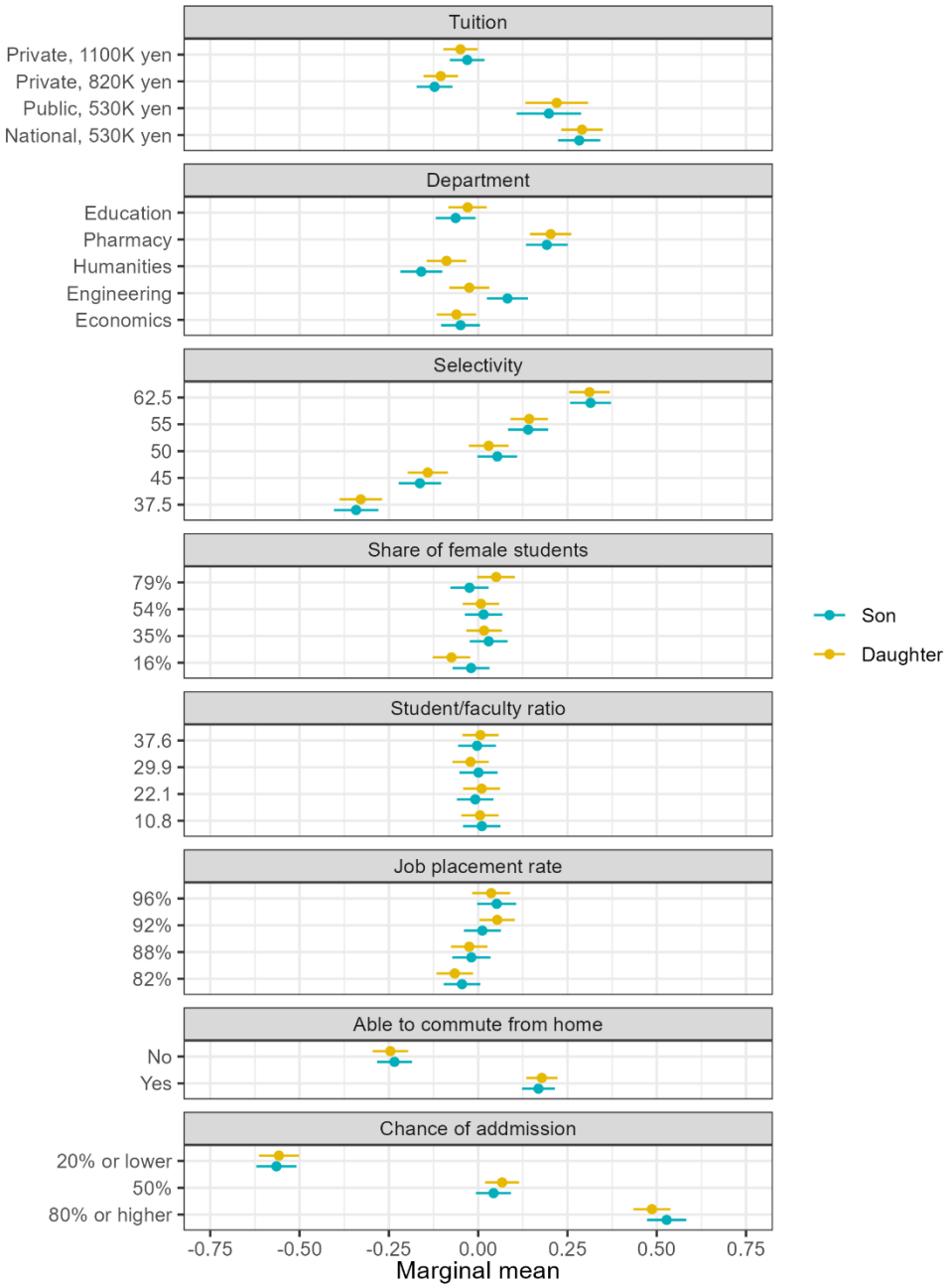

Figure 2 Centered marginal means of each attribute-level for fictitious sons and daughters

Note: Marginal means are centered by the respective grand mean for sons and daughters.

Table 1 Attributes and levels in the conjoint experiment

Attribute	Level
Tuition and university type	National university, tuition 530k JPY Public university, tuition 530k JPY Private university with low tuition (820k JPY) Private university with high tuition (1,100k JPY)
Department	Economics Engineering Humanities Pharmacy Education
Selectivity (*hensachi*, rank based on the nationwide mock exam, the higher the more selective)	37.5 45 50 55 62.5
Share of female students	16% 35% 54% 79%
Student-faculty ratio	10.8 22.2 29.9 37.6
Job placement rate	82% 88% 92% 96%
Able to commute from home or not	Yes No
His/her chance of admission	80% or higher 50% 20% or lower

Table 2 Regression results testing Hypotheses 1, 2a, 2b, and 2c (n=45,000)

	Estimate	Std. Error	Pr(>|t|)
Model (1)			
Selectivity score = 37.5	−0.41	0.03	0.00
Selectivity score = 45	−0.21	0.03	0.00
Selectivity score = 55	0.09	0.03	0.00
Selectivity score = 62.5	0.26	0.03	0.00
Daughter	0.04	0.03	0.08
Selectivity score = 37.5 * Daughter	0.04	0.04	0.26
Selectivity score = 45 * Daughter	0.02	0.04	0.60
Selectivity score = 55 * Daughter	0.01	0.04	0.75
Selectivity score = 62.5 * Daughter	0.01	0.04	0.75
Intercept	−0.41	0.03	0.00
Model (2)			
Male-female ratio = 84:16	−0.01	0.02	0.77
Male-female ratio = 63:35	0.05	0.02	0.05
Male-female ratio = 54:46	0.03	0.02	0.26
Daughter	0.12	0.02	0.00
Male-female ratio = 84:16 * Daughter	−0.11	0.03	0.00
Male-female ratio = 63:35 * Daughter	−0.08	0.03	0.02
Male-female ratio = 54:46 * Daughter	−0.06	0.03	0.07
Intercept	2.73	0.03	0.00
Model (3)			
Commute from home	0.40	0.02	0.00
Daughter	0.05	0.02	0.01
Commute from home * Daughter	0.02	0.02	0.44
Intercept	2.77	0.03	0.00
Model (4)			
Female typical major	−0.03	0.02	0.08
Daughter	0.00	0.02	0.99
Female typical major * Daughter	0.11	0.02	0.00
Intercept	2.83	0.03	0.00

Note: These models include other experimental attributes.

Table 3 Regression results testing Hypothesis 3a and 3b (n=23,254)

	Estimate	Std. Error	Pr(>|t|)
Model (5)			
Daughter	0.10	0.03	0.00
Gender gap in expected returns (10%)	0.04	0.01	0.00
Daughter * Gender gap in expected returns	−0.06	0.02	0.00
Intercept	3.58	0.02	0.00
Model (6)			
Daughter	0.06	0.03	0.04
Gender essentialist ideas (standardized)	0.02	0.02	0.30
Daughter * Gender essentialist ideas	−0.09	0.03	0.00
Intercept	3.61	0.05	0.00

Supplementary Materials for

"Gendered Parental Preference for College Applications: Experimental Evidence from a Gender Inegalitarian Education Context"

A. Definition of college selectivity

In this study, we categorize universities based on selectivity in the following way. First, a group of 29 selective national and public four-year universities is categorized as "Selective National and Public." Although a majority (22 out of 29) of these schools are national universities (e.g., former imperial universities), we also included seven selective public universities. More specifically, these universities include Tokyo, Kyoto, Tohoku, Kyushu, Hokkaido, Osaka, Nagoya, Tokyo Institute of Technology, Tokyo Medical and Dental University, Hitotsubashi, Chiba, Tokyo University of Foreign Studies, Tsukuba, Ochanomizu, Yokohama National, Niigata, Kanazawa, Okayama, Hiroshima, Nagasaki, and Kumamoto (national universities), Tokyo Metropolitan, Yokohama City, Nagoya City, Kyoto Prefectural, Osaka City, Osaka Prefectural, and Kobe City University of Foreign Studies (public universities). Other national and public universities are categorized as "Other National and Public."

Similarly, we also created a group of selective private universities. First, we relied on the threshold used in previous studies (Kaneko 1996; Toyonaga 2022) to distinguish selective and non-selective private universities. The threshold is whether the institution was established before 1960, which is characterized by the first stage of college expansion. The rationale here is elite private institutions were established before the period of expansion, so the threshold is a useful proxy of selectivity and prestige. In addition to this definition, we distinguished selective private

institutions based on their prestige. In result, we grouped 29 selective private universities as "Selective Private". This groups includes Keio, Waseda, Sophia, Tokyo University of Science, International Christian University, Meiji, Aoyama Gakuin, Rikkyo, Chuo, Hosei, Gakushuin, Kwansei-Gakuin, Kansai, Doshisha, Ritsumeikan, and other medical school based universities. Note that this is a small fraction of about 790 private universities in Japan. Next, we grouped 70 private universities as "Moderately Selective Private." They are universities established before 1960 but not as selective as the first group. This group includes universities like Senshu University, Tsuda College, Nihon University, Chukyo University, Kindai University, or Seinan Gakuin University. Other private universitas are categorized as "Non-selective Private."

B. Representativeness of the survey

Comparing the distribution of three demographic characteristics between surveys and the national census, we can see that the distribution of gender is almost identical, although we see that some people chose “do not want to answer” or “non-binary.” For area of residence, we can see that slightly more people than expected answered they live in Kanto region, where Tokyo is located, while other relatively rural regions such as Tohoku, Chubu, Kyushu have fewer respondents than expected. This can be because people may have moved to metro-areas after they registered for the online panel. For age, we see that there is some discrepancies but the general pattern looks similar.

Table A1 Comparison of three demographic characteristics between surveys and the national census

	N	%	% census
Gender			
Female	1,488	49.6%	50.5%
Male	1,476	49.2%	49.5%
Other/Do not want to answer	36	1.2%	
Region			
Hokkaido	143	4.8%	4.3%
Tohoku	155	5.2%	6.9%
Kanto	1,169	39.0%	35.1%
Chubu	495	16.3%	18.0%
Kansai	519	17.3%	16.2%
Chugoku	152	5.1%	5.7%
Shikoku	69	2.3%	2.9%
Kyushu	298	10.0%	11.0%
Age			
20-24	113	3.8%	6.3%
25-29	260	8.8%	6.4%
30-34	192	6.4%	6.9%
35-39	275	9.2%	7.9%
40-44	253	8.5%	9.1%
45-49	363	12.1%	10.6%
50-54	275	9.1%	9.4%
55-59	250	8.4%	8.6%
60-64	276	9.1%	8.1%
65-69	216	7.2%	9.0%
70-74	386	12.7%	10.1%
75-79	141	4.7%	7.7%

Note: The national census figures are based on the population of 20 to 79 years old.

C. Survey Wording

Items with a dagger mark were displayed in a randomized order.

Attention check

We repeated this attention check up to twice. For respondents who did not follow the instructions in the first attempt, we repeated the question again with "please select both 'several times in a month' and 'several times in a year' from the options" in bold font. Those who failed to pass the second attempt are immediately excluded from the survey.

In recent years, more and more people are getting news online instead of from newspapers. Here, we want to confirm that you carefully read the question texts. Regardless of how frequently you actually obtain news online, please select both "Several times in a month" and "Several times in a year" from the options. (近年、紙の新聞ではなくオンラインでニュースを得る人がどんどん増えてきています。ここで、あなたがきちんと質問文を読んでいるかどうかをテストしてみたいと思います。あなたが実際にどのくらい頻繁にオンラインでニュース情報を入手しているかどうかにかかわらず、選択肢のうち「月に何度か」と「年に何度か」の両方を答えとして選んでください。)

- Every day (毎日)
- Several times in a week (週に何度か)
- Several times in a month (月に何度か)
- Several times in a year (年に何度か)
- Not at all (まったくない)

Gender

What is your gender? (あなたの性別をお答えください。)

- Man (男性)
- Woman (女性)
- Non-binary/third gender (ノンバイナリー／第三の性別)
- Prefer not to say (回答したくない)

Age

In what year and month were you born? (あなたのお生まれは何年何月ですか。)

Two dropdown lists—for year ("1941 or earlier," "1942", ..., "2003," and "2004 or later") and for months (from "January" to "December)—were provided. We excluded those who chose "2004 or later" or "2003" and "March" or later from the survey.

Prefecture of residence

What is your prefecture of residence? (あなたが現在お住まいの都道府県名を教えてください。)

Respondents answered this question using a dropdown list that included 47 prefectures and "Overseas." We excluded those who chose "Overseas" from the survey.

Gender essentialist ideas

The following are opinions about the role of men and women. What do you think about them? Please choose the closest options to your thoughts for each statement. (男女の役割について、次のような意見があります。あなたはどう思いますか。それぞれについてあなたの考えにもっとも近い選択肢をひとつ選んでください。)

- Men's job is to earn money; women's job is to take care of the home and family. (男性の仕事は収入を得ること、女性の仕事は家庭と家族の面倒をみることだ)†
- Children of below school age tend to have a tough time if their mothers work outside of the home. (母親が外で働くと、小学校に通う前の子どもはつらい思いをしやすい)†
- Having a job is the best way for women to be independent. (女性が自立するためには、仕事を持つのが一番良い)†
- Women are better suited than men for housework and childcare. (家事や育児には、男性よりも女性がむいている)†
- Boys and girls should be raised differently. (男の子と女の子は違った育て方をすべきである)†
- Men are more capable of using mathematics and specialized skills. (男性の方が数学や専門的な技術を使う能力が高い)†

- Agree (そう思う)
- Somewhat agree (どちらかといえばそう思う)
- Somewhat disagree (どちらかといえばそう思わない)
- Disagree (そう思わない)

We inverted values except for the third question, so that we can interpret the higher score indicates more gender essentialist ideas.

Expected economic returns to college attendance

The benefit of going to college is measured by the difference in salary between working as a high school graduate and working as a college graduate. However, going to college costs money for tuition and living expenses, as well as losing the opportunity to earn a salary and develop a career by working for four years as a high school graduate. (大学進学による便益は、高卒で働いた場合と大卒で働いた場合の給与差で求められます。しかし大学進学には、学費や生活費などの費用が掛かるほか、高卒で 4 年間働いて給与を得たりキャリアを積んだりする機会を失ってしまいます。)

How likely do you think it is that a student graduating from high school this March will be able to make up this difference within five years of graduation if he or she goes on to a four-year college? Please answer for each of the male and female students. (あなたは、今年 3 月に高校を卒業する生徒が四年制大学に進学した場合、大学卒業後 5 年以内にどのくらいの確率でこの差を取り戻すことが出来ると思いますか。男子生徒の場合と女子生徒の場合のそれぞれについてお答えください。)

Respondents answered this question using a slider ranging from 0 to 100, separately for male and female students.

Brief Sensation-Seeking Scale

From the original battery developed by Hoyle et al. (2002), we selected four items used in Kam (2012), where the items were used to measure respondents' risk attitudes.

What is your level of approval or disapproval of the following statement? (次の記述に対するあなたの賛否の程度を選んでください。)

- I would like to explore strange places. (私は未知の場所を探索したい)†
- I like to do frightening things. (私は人がぎょっとするようなことをするのが好きだ)†
- I like new and exciting experiences, even if I have to break the rules. (たとえルールを破ることになったとしても、私は新しくて刺激的な体験が好きだ)†
- I prefer friends who are exciting and unpredictable. (私は豪快で予測できないことをする友人を好む)†

- Strongly disagree (強く反対する)
- Disagree (反対する)
- Neither agree nor disagree (どちらとも言えない)
- Agree (賛成する)
- Strongly agree (強く賛成する)

Tendency to bring an umbrella with them

When going to a new place, at what chance of rain do you bring an umbrella with you? (あなたは、初めて行く場所にお出かけになる時に、どのくらいの確率で雨が降りそうであったら傘を持って出かけますか。)

- 0%
- 10%
- 20%
- 30%

- 40%
- 50%
- 60%
- 70%
- 80%
- 90%
- 100%

Marital status

We will ask you about your marital status and partner. This includes common-law marriages as well. (結婚や配偶者のことについてお聞きします。ここでは、事実婚も含みます。)

Are you currently married? (あなたは現在結婚されていますか。)

- Never married (結婚したことはない（未婚）)
- Married (with a partner) (結婚している（現在配偶者がいる）)
- Divorced (離別した)
- Widowed (死別した)
- I don’t know (わからない)

Number of children

How many children have you had? Please include adopted children, stepchildren, and deceased children. (これまでにお持ちになったお子さんは何人ですか。養子・継子（連れ子）・亡くなったお子さんを含めてお答えください。)

- 0 (0 人)

- 1 (1 人)
- 2 (2 人)
- 3 (3 人)
- 4 (4 人)
- 5 (5 人)
- 6 (6 人)
- 7 (7 人)
- 8 (8 人)
- 9 or more (9 人以上)

Respondents with one or more children were asked the following five questions for each of their children, up to the eldest three. The third and fourth questions are not used in this study but are included here for reference.

Children's gender

Please answer the following questions for each child. Please include children who are already adults and children living apart. (If you have four or more children, please answer up to the eldest three.) (お子さんひとりひとりについて、以下の質問にお答えください。すでに成人されているお子さんや別居中のお子さんについてもお答えください。（お子さんが 4 人以上いる場合には、上から 3 番目のお子さんまでについてお答えください）)

For the most/second/third senior child (1 番/2 番目に/3 番目に/年上のお子さん)

What is this person's gender? (この方の性別をお答えください。)

- Man (男性)
- Woman (女性)

Children's birth year

When is this person's birth year? (この方の出生年をお答えください。)

A dropdown list of year ("1959 or earlier," "1960", ..., "2023") was provided.

Relationship with the child

What is the relationship between you and this person? (この方とあなたとの続柄をお答えください。)

- Biological child (実子)
- Adopted child or stepchild (養子・継子（連れ子）)

Current co-residence status

Do you currently live with this person? (現在、あなたはこの方と同居していますか。)

- Living together (同居)
- Living separately (別居)
- Deceased (すでに亡くなっている)

Child's educational attainment

Please indicate the school this person is currently attending or, if not, the last school they attended. Treat a dropout as equivalent to graduation. (この方が現在在学・在園中または、最後に行かれた学校等をお答えください。中退も卒業と同じ扱いでお答えください。)

- This person has not started preschool or daycare yet. (まだ幼稚園・保育所（保育園）に行っていない)
- Preschool (幼稚園)
- Daycare (保育所（保育園）)
- Elementary school or junior high school(小学校・中学校)
- High school (高等学校)
- Technical college (専門学校・専修学校)
- Junior college or college of technology(短大・高専)
- College (大学)
- Graduate school (大学院)
- Other (please specify) (その他（具体的にご記入ください）)

Preliminary explanation of the conjoint experiment

“Son” or “daughter” was randomly assigned at the respondent level.

From the next page onward, you will be asked to answer questions on the assumption that you have a [son/daughter] who is a second-year high school student. (次のページ以降、あなたに高校2年生の[息子/娘]さんがいるという想定で、質問にお答えいただきます。)

You will be shown 15 similar tables in a row, but the content of each table is not the same. Please read each table carefully before answering the questions. (同じような表が続けて 15 回表示されますが、それぞれの表の内容は同じものではありません。一つひとつの表をよくご確認の上、ご回答いただきますようお願いします。)

Conjoint experiment

Suppose you have a [son/daughter] who is now a second-year high school student. Suppose that your [son/daughter] wants to attend a four-year college and is preparing to take the general entrance examination with the following college as his first choice. Please read the table carefully and answer the questions. (いま、あなたに高校 2 年生の[息子/娘]さんがいたとします。[息子/娘]さんは四年制大学への進学を志望しており、以下の大学を第一志望として、一般入試の受験準備をしているとします。表をよく読んで質問にお答えください。)

[A conjoint table was displayed here.]

To what extent would you recommend that your [son/daughter] apply to this college (apply for the general entrance examination), given that [he/she] goes on to college? (大学進学を前提とした場合に、あなたは[息子/娘]さんに、この大学への受験（一般入試への出願）をどの程度勧めますか？)

Respondents answered this question using a six-point scale with labels “Do not recommend at all” (全く勧めない) and “Strongly recommend” (強く勧める) at the ends of the pole. The task was

repeated 15 times per respondent. The translated attributes and levels of the conjoint table are shown in Table 1 in the main text. Table A2 shows them in the original Japanese.

Table A2 Attributes and levels in the conjoint experiment in the original Japanese

Attribute	Options
経営・年間授業料	国立・53 万円
	公立・53 万円
	私立・82 万円
	私立・110 万円
学部	経済学部
	工学部
	教育学部
	薬学部
	文学部
大学の偏差値レベル	偏差値 37.5
	偏差値 45
	偏差値 50
	偏差値 55
	偏差値 62.5
入学者の男女比	男 84:女 16
	男 65:女 35
	男 46:女 54
	男 21:女 79
教員一人当たりの学生数	10.8 人
	22.2 人
	29.9 人
	37.6 人
卒業生の就職率	82%
	88%
	92%
	96%
通学	自宅から通える
	自宅からは通えない
[息子/娘]さんの合格可能性	A（80%以上）
	C（50%程度）
	E（20%以下）

D. Descriptive statistics

Table A3 Summary statistics of respondent-level variables

	Mean	SD	Min	Max
Gender gap in expected returns	6.77	16.00	−94.00	100.00
Gender essentialist ideas	1.18	0.51	0.00	3.00
Gender	0.50	0.50	0.00	1.00
Age	50.87	15.86	20.00	79.00
Region of residence	0.56	0.50	0.00	1.00
Marital status	0.73	0.45	0.00	1.00
Have a child	0.59	0.49	0.00	1.00
Number of children (logged)	0.64	0.57	0.00	2.20
Have a son	0.44	0.50	0.00	1.00
Have a daughter	0.42	0.49	0.00	1.00
Have a child of high school or less	0.21	0.41	0.00	1.00
Risk preference score (1)	1.63	0.68	0.00	4.00
Risk preference score (2)	4.50	2.07	0.00	10.00

E. Discussion on the profile distribution

As de la Cuesta et al. (2022) emphasize, in conjoint experiments, average marginal component effects (AMCEs) for an attribute highly depend on the distribution of the remaining attributes if that attribute interacts with the other attributes. Therefore, it is essential to adjust the distributions of the profiles to those in the real world as much as possible to improve the external validity of the findings. Therefore, assuming no three-way or higher-order interactions (de la Cuesta et al. 2022), we set the marginal distribution of the levels of each attribute to the real-world observations if the relevant information is available.

Specifically, for the "tuition and university type" attribute, we assigned 17%, 5%, and 78% to national, public, and private universities, respectively. Because we do not have statistics about the distribution of tuition among private universities, we evenly split the proportion of the private universities to the low and high tuition conditions. We also utilized the statistics of the percentage of students who commute to college from home and assigned 58.2% to "Yes" and 41.8% to "No." Moreover, for continuous attributes with four categories—specifically, the "share of female students," "student-faculty ratio," and "job placement rate" attributes, we collected these data of all four-year colleges in Japan from Obunsha's database for high school students, Passnavi (https://passnavi.obunsha.co.jp/), and detected the 12.5. 37.5, 62.5, and 87.5 percentiles of these variables. For the "selectivity" attribute, which consists of five levels, we relied on the same data and adopted the 10, 30, 50, 70, and 90 percentiles.

As the real-world statistics are unavailable for the remaining attributes—"department" and "chance of admission," we employed a uniform distribution for them. Regarding the "department," some may think that we could obtain the relevant distribution from Passnavi.

However, we did not do so because the departments in universities cannot be clearly categorized (e.g., joint departments like “the Department of Law and Economics” are prevalent, and the study of education is sometimes covered by humanities-related departments). Moreover, it is less meaningful to consider the adjustment of the profile distribution of this attribute because the levels are not exclusive. For these reasons, we adopted a uniform distribution for the “department” attribute. Nonetheless, we realized that this decision could influence the interpretation of the results, especially the estimates of the marginal means (MMs) of the fictitious child’s gender, which led us to change the pre-registered way of analysis for Hypothesis 1. We discuss this issue in Section F.

F. Deviations from the pre-analysis plan

This section explains three deviations from the pre-analysis plan and particularly elaborates on the rationale of the decision on the first point.

First, we changed the analysis method to test Hypothesis 1. In the pre-analysis plan, we stated that we would test Hypothesis 1 by examining whether sons are more likely to be encouraged to apply to the college of selective score 62.5 than daughters. Specifically, the planned analysis was a simple regression in which responses would be regressed on a dummy variable for whether the respondent is assigned to the daughter condition using data of only the cases of selective score 62.5. The coefficient of the daughter dummy represents the conditional AMCE of the fictitious child being female, and we expected that it would be negative.

This analysis assumed that the AMCE of the fictitious child's gender (or that conditioned by selectivity) straightforwardly represents how respondents are positive or negative about the daughter's enrollment in college compared with the son's. However, as discussed in Footnote 14 in the main text, this does not hold true in this study's case due to the strong interaction between the child's gender and the department treatment and the imbalance of the profile distribution of the departments. Our respondents tended to rate favorably when the female child was aimed at female-typical departments, while the conjoint setting made female-typical programs appear more than male-typical programs, with a ratio of three to two. Given this condition, it is a natural consequence that the AMCE of being female becomes positive. Indeed, the aforementioned pre-registered analysis revealed that the coefficient of the daughter dummy was estimated to be positive. However, this quantity does not reflect people's general preferences for the son's and daughter's attendance at selective colleges.

Therefore, instead of the pre-registered model, we employed Model (1) presented in the main text, which compares the AMCE of being female conditioned on the selective score of 62.5 compared with that conditioned on the selective score of 50. That is, while the pre-registered model pertains to the absolute conditional AMCE, Model (1) addresses the relative conditional AMCE compared among the cases of the selective scores of 62.5 and 50. Because the imbalance of the profile distribution of the departments also matters in the case of the selective score of 50, referencing this case is expected to cancel the influence of the imbalance.

The rest of the deviations are minor. Second, we change the approach of the robustness checks addressing the susceptivity of the conditional AMCE to the choice of base categories in regression models. The details are explained in the next section. Third, although we pre-registered that our questionnaire would include a question about "expected education for their children" for exploratory analysis, we did not include it. This is an unintentional mistake as we did not reflect the finalized questionnaire in the pre-registered document. We regret this error.

G. Non-centered marginal means

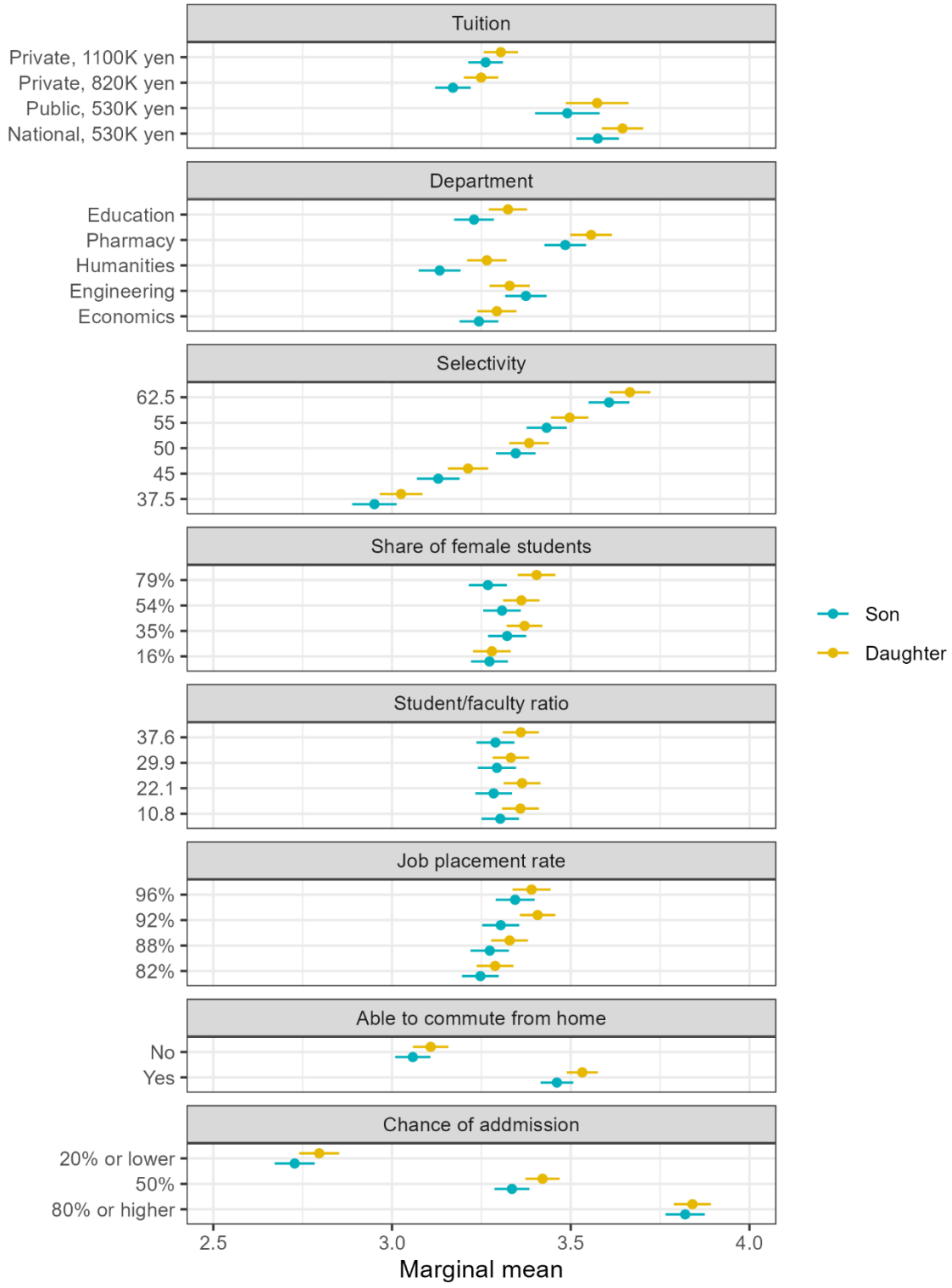

Figure A1 Non-centered marginal means of each attribute-level for fictitious sons and daughters

H. Robustness checks using different settings of the base category when estimating the conditional AMCEs

We conducted additional analyses to test Hypotheses 1, 2a, 2b, and 2c as robustness checks. These checks address the concern that the conditional AMCE is susceptible to the choice of the base category for attributes with more than two levels (Leeper et al. 2020). We stated that we would conduct robustness checks in which we would alter the base category in regression models in the pre-analysis plan. However, we later reconsidered that our interest did not lie in the conditional AMCEs per se. Instead, it should be more informative to directly demonstrate that the effects of each attribute differ as a whole by a fictitious child's gender for the additional tests of the hypotheses. Therefore, we adopted the concept of the average marginal interaction effects (see Egami and Imai 2019 for the definition of this quantity) and tested the existence of these interaction effects by joint-significance *F*-tests. This approach is also recommended by Leeper et al. (2020). Although this issue of the conditional AMCE is irrelevant to Hypotheses 2b and 2c because the concerned attribute has only two levels in Models (3) and (4), we also conducted the *F*-tests for the attributes related to these hypotheses, along with attributes unrelated to our hypotheses for reference.

Specifically, we conducted the analysis of variance to compare the following two regression models: (a) a model in which the outcome variable was regressed on dummy variables for the conjoint attributes and a dummy variable indicating that a fictitious child is female and (b) a model including interaction terms between a set of dummy variables for the relevant attribute and the fictitious daughter dummy as well as explanatory variables included in Model (a). That is, Model (a) is as follows:

$$y_{ij} = \alpha + \sum_{kl} \beta_{kl} x_{ijkl} + \gamma z_i + \varepsilon_{ij} \text{ ..... (A1).}$$

For example, as a robustness check for Hypothesis 1, we compared Models (A1) and (1). The *F*-test considers the null hypothesis that all the coefficients of the interaction terms added in Model (b) are zero, which indicates the non-existence of the average marginal interaction effects (Egami and Imai 2019). This test does not depend on the selection of the base category.

Table A4 shows the *p*-values of the *F*-tests. Regarding Hypotheses 2a and 2c, which we found supportive evidence in the primary analyses, the *F*-tests indicate that there are indeed significant interactions between the "share of female students" and "department" attributes and a fictitious child's gender. In contrast, the results do not provide evidence of significant interactions between the "selectivity" and "able to commute from home or not" attributes and a fictitious child's gender, which also aligns with our conclusions in the main text.

Table A4 Results of the *F*-tests for the interactions between the attributes and a fictitious child's gender

	p-value	Related hypothesis
Tuition and university type	0.855	
Department	0.000	Hypothesis 2c
Selectivity	0.833	Hypothesis 1
Share of female students	0.008	Hypothesis 2a
Student-faculty ratio	0.792	
Job placement rate	0.445	
Able to commute from home or not	0.439	Hypothesis 2b
His/her chance of admission	0.038	

I. Heterogeneity by respondent-level characteristics

We explored whether various respondent-level characteristics interacted with their heterogeneous preferences for a fictitious child's school admission by his or her gender. As per pre-registration, we focused on respondents' gender, age, region of residence, marital status, household composition, and risk preference. The details of the variables are as follows:

Gender: We treated "Non-binary/third gender" and "Prefer not to say" as missing and created a dummy variable for female respondents.

Age: We treated this variable as continuous.

Region of residence: We dichotomized this variable for simplicity and created a dummy variable indicating that the respondent lived in metropolitan areas (specifically, in either of Saitama, Chiba, Tokyo, Kanagawa, Aichi, Kyoto, Osaka, and Hyogo prefectures).

Marital status: We used a dummy variable for being married (including divorced and widowed).

Household composition: We created the following five variables: (1) a dummy variable indicating that the respondent had at least one child, (2) the number of children (logged after adding one), (3) a dummy variable indicating that the respondent had at least one son, (4) a dummy variable indicating that the respondent had at least one daughter, and (5) a dummy variable indicating that the respondent had at least one child whose school grade was high school or less.

Risk preference: We used the following two variables: (1) the average of responses to questions in the Brief Sensation-Seeking Scale (Hoyle et al. 2002), and (2) a continuous variable of

respondents' tendency to bring an umbrella with them. See Section C for the details of the questionnaire.

This exploratory analysis addresses the three-way interaction between the conjoint attribute, a fictitious child's gender, and the respondent-level variable. To examine such interactions, we conducted *F*-tests similar to those in Section H. For each attribute and each respondent-level variable, we compared the following two models: (a) a model in which the outcome variable was regressed on dummy variables for the conjoint attributes, a dummy variable indicating that a fictitious child is female, the concerned respondent-level variable, and all combinations of two-way interaction terms between the dummy variables of the concerned attribute, the fictitious daughter dummy, and the concerned respondent-level variable, and (b) a model in which three-way interaction terms between the dummy variables of the concerned attribute, the fictitious daughter dummy, and the concerned respondent-level variable are added to Model (a). The *F*-tests assessed the joint significance of the coefficients of the three-way interaction terms.

As we had eight conjoint attributes and 11 respondent-level variables, we repeated the *F*-tests 88 times, which should increase the likelihood of false positives. Thus, we adjusted *p*-values by the Holm correction for multiple testing.

Table A5 shows the adjusted *p*-values of the *F*-tests for each pair of the conjoint attributes and respondent-level variables. The tests detected a significant interaction at the 5% level only between the "chance of admission" attribute and respondents' marital status.

Because the *F*-test alone does not tell us how different married and unmarried respondents' preferences were, we need to examine it by illustrating conditional marginal means. Figures A2 and A3 draw the marginal means for married and unmarried respondents,

respectively. The bottom panels of these figures present that unmarried respondents were more sensitive to a fictitious child's chance of admission when the child is male than when the child is female, while such a tendency was not observed among married respondents; the *F*-test seemed to detect this difference as statistically significant. However, we do not have a theoretical framework to explain this difference by respondents' marital status.

Table A5 *P*-values of the *F*-tests for the three-way interactions between the attributes, a fictitious child's gender, and respondent-level variable

	(1)	(2)	(3)	(4)
Gender	1.000	1.000	1.000	1.000
Age	1.000	1.000	1.000	1.000
Region of residence	1.000	1.000	1.000	1.000
Marital status	1.000	1.000	1.000	1.000
Have a child	1.000	1.000	1.000	1.000
Number of children (logged)	1.000	1.000	0.913	1.000
Have a son	1.000	1.000	1.000	1.000
Have a daughter	1.000	1.000	0.817	1.000
Have a child of high school or less	1.000	1.000	1.000	1.000
Risk preference score (1)	1.000	1.000	0.136	1.000
Risk preference score (2)	1.000	1.000	1.000	1.000
	(5)	(6)	(7)	(8)
Gender	1.000	0.271	1.000	1.000
Age	1.000	1.000	1.000	1.000
Region of residence	0.089	1.000	1.000	1.000
Marital status	1.000	1.000	1.000	0.036
Have a child	1.000	1.000	1.000	1.000
Number of children	1.000	1.000	1.000	1.000
Have a son	1.000	1.000	1.000	1.000
Have a daughter	1.000	1.000	1.000	1.000
Have a child of high school or less	1.000	1.000	1.000	1.000
Risk preference score (1)	1.000	1.000	1.000	1.000
Risk preference score (2)	1.000	1.000	1.000	1.000

Note: Conjoint attributes are as follows: (1) Tuition and university type, (2) Department, (3) Selectivity, (4) Share of female students, (5) Student-faculty ratio, (6) Job placement rate, (7) Able to commute from home or not, and (8) His/her chance of admission. *P*-values were adjusted by the Holm correction for multiple testing.

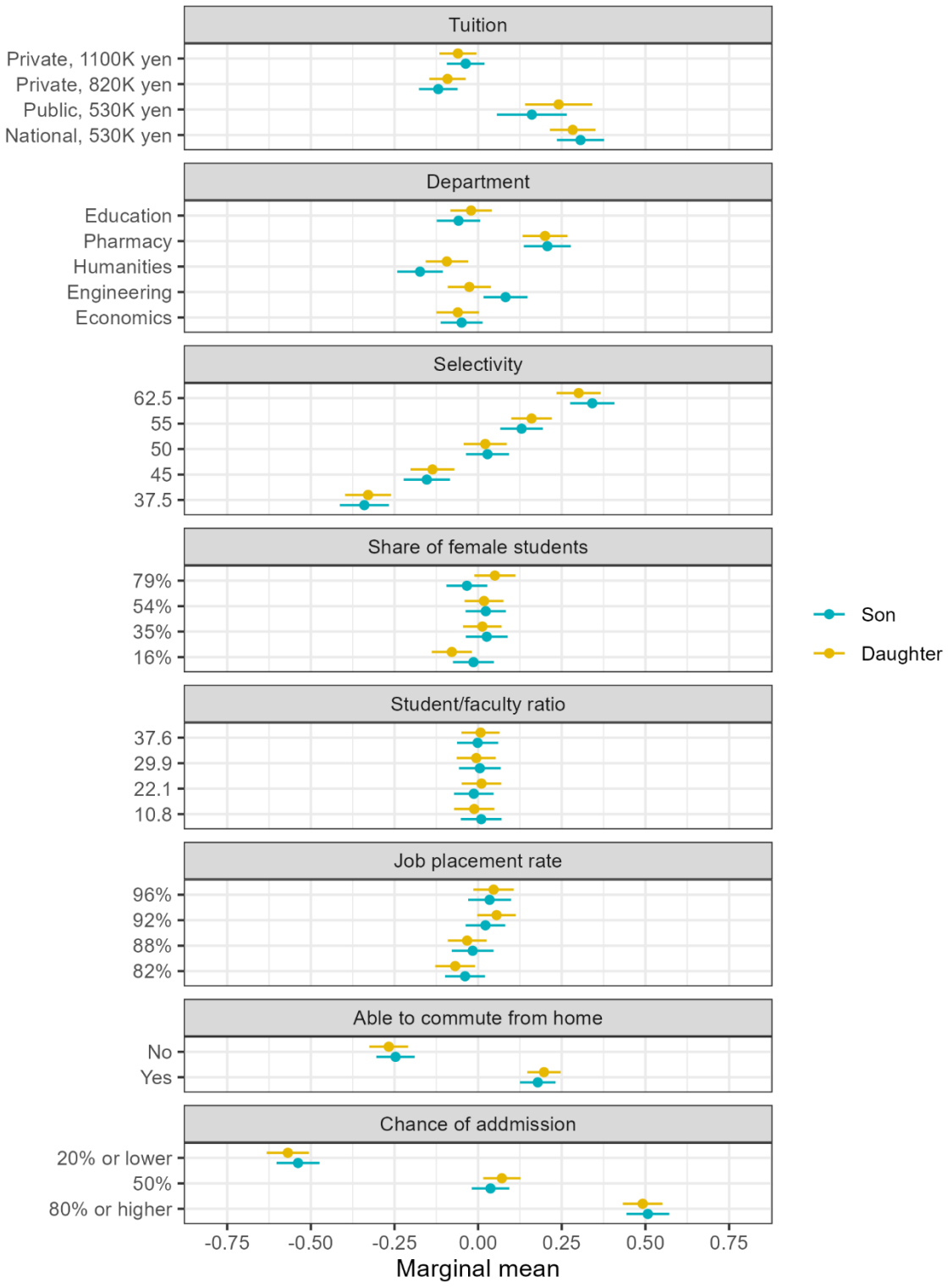

Figure A2 Marginal means of each attribute-level for married respondents

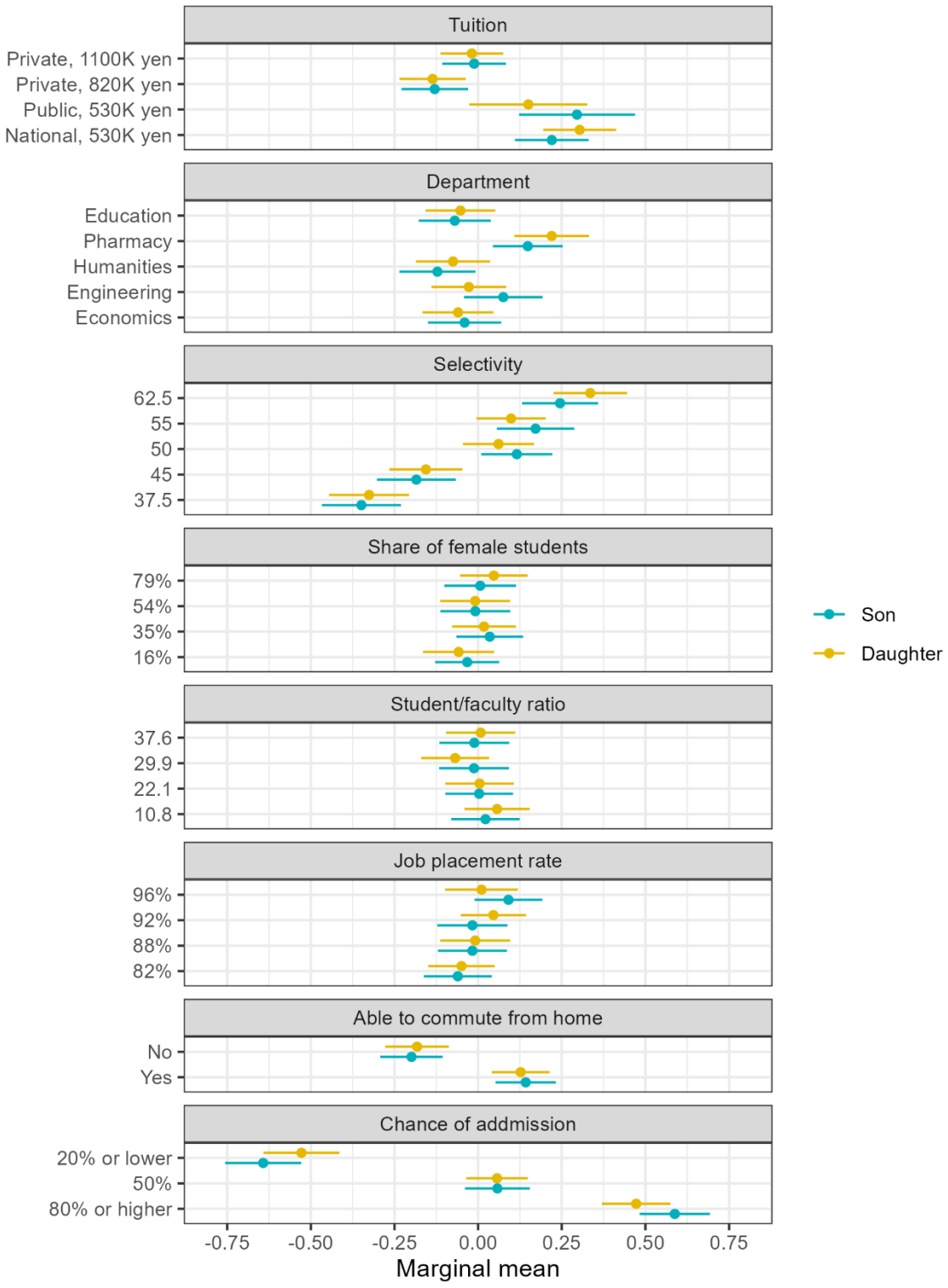

Figure A3 Marginal means of each attribute-level for unmarried respondents

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