Gendered Aspirations for Selective University in Japan

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1 Introduction

The persistent gender gap in selective university attendance remains a puzzling stagnation in Japan. Despite near-parity in attainment of tertiary education, women are significantly underrepresented at the national and public universities, generally perceived as more prestigious than most private universities. A well-known example of this is the proportion of female undergraduates at the University of Tokyo, which has hovered around 20% for nearly two decades (UTokyo Office for Gender Equality, 2024). Notably, this is observed to be driven by low applications from female students, so the puzzle lies not in selection at the admission level, but application level (Uchikoshi et al., 2024).

The Japanese education system resembles a tournament model, in which the losers lose forever and winners are allowed to continue (Rosenbaum, 1976). Surviving winners aim to attend a selective university for large advantages in the labor market in terms of earnings and firm placement (Abe, 2002; Ono, 2004). With the perception that failure to attend a selective high school eliminates chances for selective university altogether (Takeuchi, 1991), the transition into competitive high school is likely an early signal of incompetence for selective university.

Utilizing a panel survey following school-aged children in Japan, I estimate the effect of a disappointing high school enrollment, a "bad update," on students' reported aspirations to attend selective university. I find that the effect of a bad update, for students who report as such, is positive with respect to the likelihood of reporting an aspiration for selective university. For such students, undergoing a bad update is associated with approximately a 7-8% increase in the likelihood of aspiring for selective university. Furthermore, there is suggestive evidence that this effect is more salient for female students than male students. The results offer descriptive insight into the dynamics of the Japanese education leaky pipeline.

2 Background

2.1 Literature

To explain dominated choices in educational contexts, prior research has highlighted expected costs (Shorrer & Sóvágó, 2023, 2024) and non-traditional preferences (Dreyfuss et al., 2022). Specifically in the Japanese setting, Kariya and Rosenbaum (1987) argue that the highly stratified and thus highly informative nature of the Japanese education system affects students' plans for educational and vocational futures. However, their empirical analysis highlights the relationship between changes in academic achievement and future plans. Given that academic achievement is plausibly tangible in similar ways in other countries, it is unclear if it is specifically the informative nature of the Japanese system that causes students to update their future aspirations. Furthermore, to return to the puzzle of low female applications to selective universities, existing studies provide little explanation for why women and men differ in their aspiration updates. A plausible connection between these elements of dominated choice is differential response to information updates: Bobba and Frisancho (2022) find evidence that male and high-socioeconomic status students process test performance information more effectively. In other words, males and high-SES students weigh the signal of their ability relative to their prior beliefs more heavily than their counterparts (Bobba & Frisancho, 2022).

2.2 Model

In the Japanese education context, consider Halafir et al. (2018)'s model of decentralized college admissions. Each student $s \in S$ has innate ability $a_s \in [0,1]$ and exerts effort $e_s \geq 0$ to be assigned to a college $C \in \mathcal{C} := \{1,2\}$. Supposing homogeneous student preferences, students derive utility v_C from assignment to college C; let $v_2 > v_1 > 0$, such that college 2 is preferable to students. Among a set of applicants to a college, $\{s \in S \mid C_s = C\}$, each college C admits applicants with the highest effort until capacity is met. Under regularity assumptions on ability distribution, there exist symmetric and monotone Bayesian Nash equilibria in which students above and below an ability cutoff c adopt different application behavior.

Intuiting from empirical evidence of differential information processing, suppose that following an information update, students form a belief on their ability with function $\mu_s : [0,1] \to [0,1]$. Then there could exist students s_1 and s_2 such that $a_{s_1} = a_{s_2} = a^*$ but $\mu_{s_1}(a^*) \neq \mu_{s_2}(a^*)$. If μ_{s_1} and μ_{s_2} are defined such that $\mu_{s_1}(a^*) < c < \mu_{s_2}(a^*)$, their college choices C_{s_1}, C_{s_2} need not be the same despite having identical abilities. If application behavior follows Halafir et al. (2018)'s cutoff equilibrium, then s_1 uses a mixed strategy with identical effort levels, and s_2 strictly applies to $C = 2$.

The empirical gender gap in applications suggests that we may observe female students behaving like s_1 and male students like s_2.

3 Methodology

I use the Japanese Longitudinal Survey of Children and Parents (JLSCP), a national panel survey of Japanese households with school-aged children from 2015-2021 (7 waves). The survey asks households with children from 1st to 12th grades across the nation on everyday time use, children's experiences, preferences, and performance in school. The survey was conducted under the ISS BERD Joint Research Project, a collaboration between the Institute of Social Science at the University of Tokyo and the Benesse Educational Research and Development Institute. Data was provided by the Social Science Japan Data Archive, which is made available by the Center for Social Research and Data Archives under the Institute of Social Science at the University of Tokyo (Benesse Educational Research and Development Institute 2023).

Key variables are educational aspirations, the outcome of the student's middle to high school transition, and gender. To approximate aspirations, I use students' responses to the statement "I want to enter a high school (university) that is said to be difficult to enter," which indicates the degree to which students aspire to apply to a selective school. For the middle to high school transition, I look specifically at students who would update downwards – students who didn't get into the high school that they wanted. I proxy with students who reported attending a high school that was below their top two schools and label them as having undergone a "bad update."

I control for household characteristics, such as household income, parental education, monthly investment per child, and academic performance, such as grades in main subjects and choice of STEM vs. humanities tracks. The dataset offers extensive information on aspects of students' lives and school experiences that can be included as observables; alternate sets of controls are checked for consistency in the appendix.

3.1 Estimation strategy

The general estimation follows form

$$Y_{it} = \alpha + \beta D_{it} + \gamma \mathbf{X}_{it} + \delta_t + \lambda_i + \epsilon_{it}$$

where Y_{it} is student i's aspiration for selective university, D_{it} indicates whether or not a bad update has occurred by time t, $\mathbf{X}_{it}$ is a vector of controls on household and individual characteristics, δ_t is a set of time fixed effects, and λ_i is a set of individual fixed effects.

Two main issues pose obstacles to estimating the causal effect of a bad update on students' aspirations. First, the number of "treated" students who undergo the bad update in the sample is low. As a result, standard errors are large, and conventional inclusion of interaction terms or testing for heterogeneous treatment effects is difficult due to the even smaller number of treated in each subgroup. Second, students endogenously select into treatment; students

Table 1: Summary statistics

	count	mean	sd	min	max
Selective aspiration, grade 9	8093	2.530	1.036	1	4
Selective aspiration, grade 10	6920	2.418	1.025	1	4
Bad update	8736	0.026	0.160	0	1
Female	8722	0.504	0.500	0	1
Father's highest level of education	7175	3.802	1.482	1	6
Mother's highest level of education	7671	3.572	1.170	1	6
Household income	8127	5.569	1.929	1	10
Monthly investment in child	6830	5.728	2.639	1	10
Aspired level of education	5785	2.559	0.725	1	4
STEM track	7083	0.695	0.461	0	1
Japanese score	6859	3.420	1.179	1	5
English score	6860	3.414	1.333	1	5
Math score	6861	3.462	1.277	1	5
Science score	6855	3.436	1.260	1	5
Social studies score	6853	3.480	1.255	1	5
Observations	8736				

Note: All but bad update and otherwise specified are as recorded in grade 9, just prior to high school admission

who already have high aspirations are mechanically more likely to be disappointed.

To address this, estimates are checked for consistency across matching strategies, two-way fixed effects, (ordered) probit, and alternative interaction specifications. With that said, without exogenous variation or quasi-randomness to exploit, estimates in this study are better treated as descriptive results rather than causal effects.

The main findings utilize a coarse exact matching strategy to estimate the average treatment effect on the treated: the average effect of failing to attend one's top choice of high school on aspiration to attend selective university, for students who failed (Iacus, King, and Porro 2012). Matching mitigates dependence on the estimation model and bias, and using coarsened strata limits pruning of treated units, which is a priority with this data.

4 Results and discussion

4.1 Main results

Two-way fixed effects regression estimates a 7.3% increase in likelihood of aspiring for selective university associated with undergoing a bad update. It should

Table 2: Two-way fixed effects regressions, pre-matched on aspiration

	(1)	(2)
Bad update=1	0.0906***	0.0730*
	(0.0253)	(0.0364)
Constant	0.231	0.437
	(0.169)	(0.306)
Background controls	Yes	Yes
Academic controls	Yes	Yes
Time FE	Yes	Yes
Individual FE	No	Yes
N	20260	20260

Standard errors in parentheses

* $p < 0.05$, ** $p < 0.01$, *** $p < 0.001$

be noted that large standard errors reflect the small number of treated units, with only 2.6% (230 individuals) of the sample undergoing a bad update from middle to high school. It is thus unsurprising that omitting the individual fixed effect to allow for a gender-treatment interaction leads to insignificant estimates.

Regressing separately by gender, however, provides suggestive evidence that the treatment effect is driven by female students.

Repeating the analysis with redefined variables offers some descriptive insight into these estimates. First, there is no effect of a bad update on the student's reported aspired years of education. Second, attempts to estimate an effect on aspiration for a national university (often regarded as an objective tier of selective university) are uninformative.[1] Finally, redefining treatment to reflect a more objective measure of a 'bad' high school admission result, though limited to only one cohort in the data, again produces a null effect.

Null results from respecification suggest that the effect estimated from self-reported bad update and aspiration variables is distinct from, for instance, the effect of an objective failure on the quality of aspired university. The nature of these self-reported measures may point to students' self-perceptions being a key factor.

4.2 Discussion

Undergoing a bad update appears to be positively associated with aspiration for selective university, an effect driven by female students. This departs from our

[1] The specific aspiration for national university is not observed in the data, and attempts to impute using pre-transition aspiration for selective university in general, or by simply assuming students are ambivalent in middle school, lead to insignificant estimates.

Table 3: Gender-heterogeneous regressions, pre-matched on aspiration

	(1) male	(2) female	(3) male_weight	(4) female_weight
Bad update=1	0.112**	0.163***	0.0663	0.113**
	(0.0353)	(0.0357)	(0.0355)	(0.0360)
Constant	0.650***	-0.0301	0.554***	0.0100
	(0.0860)	(0.262)	(0.0913)	(0.243)
Background controls	Yes	Yes	Yes	Yes
Academic controls	Yes	Yes	Yes	Yes
Time FE	Yes	Yes	Yes	Yes
Individual FE	No	No	No	No
N	9899	10397	9863	10393

Note: The first two columns did not pre-match on aspiration; the second two did.
* $p < 0.05$, ** $p < 0.01$, *** $p < 0.001$

earlier expectation that female students behave like s_1; I explore three possible mechanisms that could explain this counterintuitive result.

4.2.1 Rank effects

One might imagine s_1 receiving a bad update by entering a low quality high school, but instead enjoying a better rank than in their counterfactual. We are then actually observing $\mu_{s_1}(a^*)'$, which could be high enough to justify an increase in probability of applying to selective university. Denning, Murphy, and Weinhardt (2023) find that students' ranks in elementary school impact long-run outcomes such as high school graduation and job earnings, with the magnitude of effects amplified for disadvantaged groups (Denning, Murphy, and Weinhardt 2023). While their work finds no ostensible gender difference, if the education and labor market disadvantage faced by low-income groups in the U.S. is similar to that faced by women in Japan, heterogeneous sensitivity to rank effects may explain our heterogeneous gender effect.

However, this explanation is undermined by the fact that female bad updaters appear to perform worse in high school, even relative to male bad updaters and non-bad updaters. This holds for their overall performance as well as performance in their chosen track of study.

4.2.2 Signal pass-through

The aforementioned Bobba and Frisancho (2022) result that males and individuals of high SES have greater signal pass-through offers an alternative explanation for the gender differential. If students indeed interpret a bad update as a signal of their ability a_s, we would expect to see $|\mu_{s_1}(a_{s_1}) - a_{s_1}| < |\mu_{s_2}(a_{s_2}) - a_{s_2}|$,

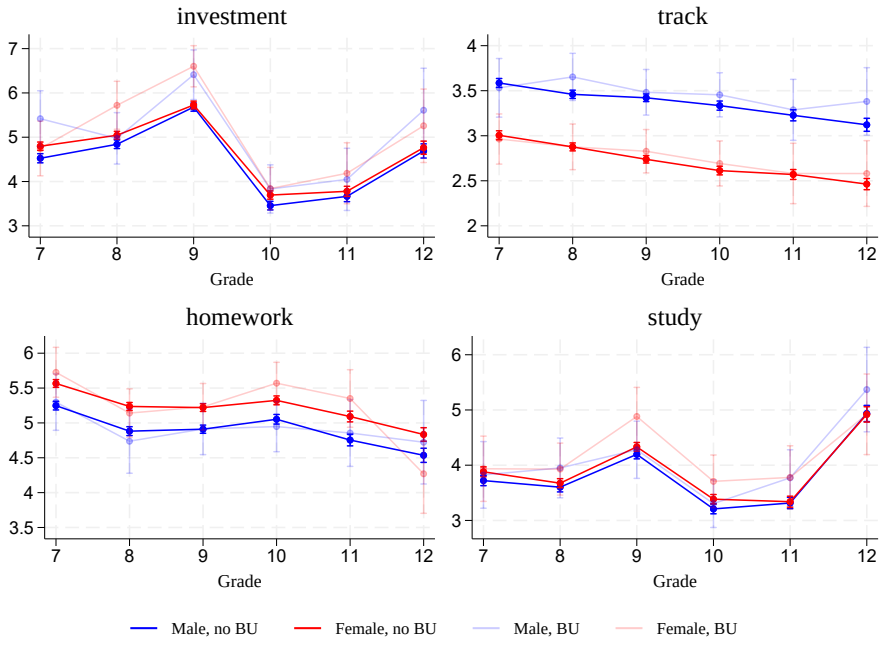

Figure 1: Mean characteristics; (Top left) Parents' monthly investment into child; (Top right) Self-reported STEM/humanities inclination; (Bottom left) Categorical time spent doing homework; (Bottom right) Categorical time spent studying.

which generally aligns with the premise set out in section 2.2. In particular, a bad update should be a negative signal on ability, which implies $a^* > \mu_{s_1}(a_{s_1}) > \mu_{s_2}(a_{s_2})$.

While we do observe the relation $\mu_{s_1}(a_{s_1}) \geq \mu_{s_2}(a_{s_2})$, our results actually suggest that $\mu_{s_1}(a_{s_1}) \geq \mu_{s_2}(a_{s_2}) = a^*$; that is, the bad update is indeed less strongly internalized by female students, but in the opposite direction, as a positive signal.

4.2.3 Expected utility

Why would female bad updaters raise aspirations following a negative signal? I find some evidence that female bad updaters, compared to all other students, have on average invested more into their education in time spent on homework and studying. Relative to non-bad updaters, they are more academically motivated by the school they aspire for, and further, their parents have invested more money.

High investment into education may reflect or potentially cause the expected utility of college admission (and the expected cost of effort associated with it) to

be systematically different. Shorrer & Sóvágó (2023) argue that students forego a free tuition waiver when their expected utility cost from that choice is low. In similar reasoning, high investment may reflect a high expected utility cost associated with revising μ_s downwards.

Finally, if the expected returns to C_2, v_2, are raised following a bad update, the homogeneous utility assumption of the DCA model fails, allowing for a profitable deviation in mimicking application behavior of s_2. In other words, female bad updaters may rationally choose to apply higher if they value selective university more strongly after a disappointing high school result. One might think of this behavior as seeking revenge, or a version of the sunk cost fallacy.

5 Conclusion

We descriptively find that failure to enter one's top choice of high school is positively associated with aspiration for selective university in Japan, and provide suggestive evidence that this result is driven by female students. Discussion of potential mechanisms highlights that models of students' application behavior should not neglect differences in information updating, which may lead to counterintuitive rebalancing of expected costs and returns. This discussion aligns with recent developments in literature on information frictions in school choice, where better information on schools' value-added, as opposed to mean achievement, can improve student outcomes (Arteaga et al. 2022; Cullen, Jacob, and Levitt 2006).

In a setting like Japan, where education is broadly highly valued, the question of who embarks on attaining such education and who gives up along the way is extremely relevant to many areas of policymaking. This paper focuses on the stages leading up to university applications, but future research could investigate if students' application behavior indeed reflects the aspiration data in this study. Moreover, more robust evidence in support of the various mechanisms that were raised speculatively, such as signal processing biases and rank effects, would greatly clarify the nature of the findings in this paper.