Dropping out of the selective university race: the effect of information updates on educational aspirations in Japan

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HONOR PLEDGE:

This paper represents my own work in accordance with University regulations

/s/ Shinrea Su

AI DISCLOSURE:

I did not use Generative AI in writing this paper.

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Abstract

In Japan, competitive admissions into high school can provide information to students on their chances for selective university admissions. In the context of a leaky pipeline, where students who aspire for selective university 'drop out' of the running along the way, I explore the role of the middle to high school transition in students' aspirations for selective university. Using a nationally representative panel survey of Japanese households, estimates from a two-way fixed effects regression with matching methods find that a disappointment in high school admission is associated with an increase in reported aspiration for selective university. Furthermore, this positive effect is more salient with female students. I discuss possible mechanisms for this counterintuitive result, highlighting factors that lead female students to disregard or willfully act against a negative signal.

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1. Introduction

The Japanese education system has been likened to a tournament model, in which the losers lose forever and winners are allowed to continue (Rosenbaum 1976). Students generally begin the competitive selection process with high school, and most of them will continue to some form of higher education – about 80% in 2015 (Research Institute for Higher Education, Hiroshima University 2015). In particular, selective universities are a highly valued good for Japanese students, as attending a selective university confers large advantages in the labor market in terms of earnings and firm placement (Ono 2004; Abe 2002). Finally, advancement in the education system is highly meritocratic in the sense that admission to selective high schools and universities is generally based on standardized exam outcomes.

The high value of education, especially selective university, and the ability-based progression to selective education provide a compelling setting for studying the dynamics of a "leaky pipeline." The pool of final applicants to selective universities represents only those who have not yet dropped out from the race. We generally only observe who survives far enough to enroll at selective universities, but given the extremely high value of selective university, it is of economic interest to explore what kinds of students drop out early, and for what reasons. Furthermore, it is at least perceived that failing to attend a selective high school may eliminate one from the running for selective university altogether (Takeuchi 1991). As such, the transition into what is likely one's first signal of incompetence for selective university is an information-rich cross-section in the overall leaky pipeline.

Moreover, the persistent and large gender gap in selective university attendance poses a policy-relevant and puzzling dimension to the problem. 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 has been observed to be driven mostly by low applications from female students, so the puzzle lies not in selection at the admission level, but application level (Uchikoshi, Miwa, and Ono 2024).

In this paper, I utilize a panel survey dataset following school-aged children in Japan to estimate the impact of the middle-high school transition on students' reported aspirations to attend selective university. I focus on students who have experienced a disappointment in the high school entrance process, referred to as a "bad update." More specifically, I ask:

Q1. Does undergoing a bad update in the middle to high school transition in Japan impact the aspiration to attend a selective university?

Q2. Do female and male students' aspirations respond differently to a bad update?

I find that the effect of a bad update, for students who report a bad update, 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. Though endogenous selection into a bad update poses an issue for much causal interpretation of the estimates, the results offer some insight into the dynamics of the Japanese education leaky pipeline.

The rest of the paper will be organized as follows: Section 2 motivates the analysis and expected results reviewing relevant economic literature; Section 3 describes the data and

empirical strategy; Section 4 presents results and discussion of possible mechanisms; Section 5 concludes with an evaluation of the paper's contributions and discussion for further study.

2. Literature review

In modeling higher education admissions, much of the existing economic literature has focused on the problem of school choice, as addressed with matching mechanisms. In such theoretical work, there is assumed to be a central clearinghouse or some central body that assigns schools to students. This is the general model explored in, for example, Gale and Shapley (1962), whose development of the deferred acceptance matching was motivated with a college admissions problem. The matchings produced by deferred acceptance have many desirable properties, such as being stable, proposer-optimal (Roth 2008) and proposer-strategy-proof (Dubins and Freedman 1981), which have led to its adoption in education markets worldwide. Unfortunately, despite the mechanism's prowess, behavior under deferred acceptance in the real-world setting often deviates from theory (see Rees-Jones and Shorrer (2023) for a review).

One common deviation is that students make dominated choices, or choices that do not align with their preferences and yet do not confer a benefit, when deciding which colleges to apply to. In Hungary, for example, a strategically simple version of deferred acceptance is used to match college applicants to programs, with and without financial aid. As Shorrer and Sóvágó (2023) find, 11% of college applicants in this system make a dominated choice of choosing to not receive a tuition waiver. These behavioral deviations from theory have a monetary cost: when possible for the applicant to have applied differently to receive a better match, the dominated choice cost the applicant approximately 6,600 dollars on average. Moreover, applicants with low academic ability and high socioeconomic status were more likely to make these dominated

choices (Shorrer and Sóvágó 2023). Further exploration of the Hungarian context reveals that selectivity, too, increases the frequency of dominated choices (Shorrer and Sóvágó 2024). These two studies lead the authors to conclude that applicants make more dominated choices when their expected cost is low – applicants may be mistakenly expecting the cost to be zero. In their discussion, they mention that non-traditional preferences could also explain their findings. Loss aversion, for example, may lead applicants to intentionally submit seemingly dominated preferences, so as to avoid the loss associated with submitting preferences for outcomes that they are unlikely to attain (Dreyfuss, Heffetz, and Rabin 2022).

A dimension that adds complexity to this picture is how people process information; that is, when evaluating expected costs and gains, different groups of individuals may assign different weights to the same underlying preferences and goods. Individuals who start with the same true ability may encounter the same information, but process that information differently. Bobba and Frisancho (2022) find evidence for this in the educational setting of Mexico City. In their study, feedback about test performance serves as the information update; in response to this update, male and high-socioeconomic status students process the 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 and Frisancho 2022).

Finally, in research concentrating on 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. Their empirical results suggest that changes in grades impact students' plans to pursue further education, as well as vocational choices. Their interpretation of this result draws a comparison between the education systems of the United States and Japan: Japan's single-minded emphasis on academic

achievement and the introduction of stratification at the high school level, they argue, encourages students to self-select into different future paths with greater clarity (Kariya and Rosenbaum 1987). The authors offer an interesting interpretation of the Japanese education structure and the information it provides to students. 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 the United States, 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.

To summarize, when students make choices in admissions-related contexts, they may make mistakes. These mistakes can be explained in part by individual characteristics such as gender or achievement; moreover, these characteristics also shape how students react to information updates. What is lacking in the current literature, however, is exploration of students' seemingly mistaken choices in decentralized admissions contexts. Studies that focus on the Japanese context also provide little evidence that the stratified, information-rich nature of the education system drives changes in aspirations. By pointing to information updating in a decentralized setting such as Japan, I attempt to build upon the aforementioned studies characterizing students' choices, and by extension, their aspirations.

Decentralized admissions in the Japanese context

To illustrate these dimensions in the Japanese education context, consider a model of the decentralized college admissions as presented by Hafalir et al. (2018), henceforth referred to as

DCA. Suppose all students have some innate ability that determines their academic success; to enter university, students put in some amount of effort. They choose which type of university they want to apply to, selective or non-selective. Universities admit the students with the highest effort among their applicants. The symmetric and monotone Bayesian Nash equilibria of students in this model are derived and experimentally tested in Hafalir et al. (2018). To summarize very broadly, there is an ability cutoff above which students apply only to the selective university, and below which students mix between the two. However, even when mixing between selective and non-selective, students choose to exert the same level of effort regardless of selectivity (Hafalir et al. 2018).

DCA differs from previously discussed models in the sense that admissions are decentralized, such that students choose themselves which college to apply to and do not submit preferences to some central body for a matching procedure. Furthermore, students in DCA may only apply to one school, which resembles how Japanese students may generally only apply to one selective university. However, previously discussed models offer dimensions of decision-making that DCA lacks: students' strategies depend on the information they have, and in particular how that information updates at certain points in time. The way students adapt their strategy also depends on individual characteristics, specifically those that influence the way they perceive themselves. Synthesizing these, I expect to find that students of the same innate ability – students that should in theory make the same decision of which university to apply to – will diverge in their university choice given an update of their self-perceived ability.

To flesh out this expectation, consider two students, A and B. Suppose A and B are identical (i.e. have the same innate ability). As such, even while A and B may have the same innate ability, they may believe themselves to have different abilities – self-perceived ability. A

and B choose strategies based upon their self-perceived ability, not their innate ability. Suppose that following an information update, A has the higher self-perceived ability and B the lower.

Under DCA equilibrium, A and B should either both strictly apply to selective universities, or both mix with identical probability between the two. But the fact that A and B act upon their self-perceived ability now implies that they could choose different strategies. For example, in the case that A's self-perceived ability is above the ability cutoff in DCA, and B's below, B could plausibly choose not to apply to a selective university when A, who is in all other respects identical, does choose to apply. B then loses out on the benefits of attending a selective university due to the information update.

I expect to empirically find such cases of students like A and B in the Japanese education context – students who in all respects should be capable of attending a selective university, but at some point whose self-perceived ability updates downwards, causing them to "drop out" of the race for a selective university. I expect that the event of high school admission, which confers a large amount of information at once to all students, will cause students to update their self-perceived ability, leading some students to stop aspiring for selective universities.

3. Methodology

Data

To empirically test these predictions, 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 of interest are educational aspirations, the outcome of the student's middle to high school transition, and gender. To approximate educational aspirations, I use students' responses to the statement

> 入るのが難しいと言われる高校（大学）に入りたい
>
> 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 high school or university.[1] 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 to get into. This is approximated by students who reported attending a high school that was below their top two schools.[2] I refer to these students 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 breadth of this dataset offers extensive information

[1] Responses to this may be subjective, but the key outcome is the change in aspiration, not the absolute level. Alternate outcomes are evaluated following the main results.

[2] Again, to check exactly what is being captured, an alternate treatment is evaluated following the main results.

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.

Summary Statistics

To provide a better understanding of the data, I produce several tables of relevant summary statistics. For this paper's analysis, only students who undergo the middle to high school transition are relevant, and thus students who do not fulfill this criterion are dropped from the sample. In the following tables, I translate a subset of relevant variables to discuss.

Table 1

Summary of response status across waves

	count	mean	sd	min	max
Wave 1	8050	.9839752	.1255787	0	1
Wave 2	7393	.9864737	.1155212	0	1
Wave 3	6697	.9850679	.1212901	0	1
Wave 4	5929	.9878563	.1095365	0	1
Wave 5	4972	.9883347	.1073851	0	1
Wave 6	3882	.9876352	.1105216	0	1
Wave 7	2710	.9841328	.1249846	0	1
Observations	8738				

Note: Response status variables were recoded to be binary such that status = 0 for a given household indicates that the household's responses are incomplete (i.e. either answered by only child or only parent, or were excluded from analysis by the creator of the dataset) and status = 1 indicates that the household's responses are complete (answered by both child and parent). No response at all was coded as a missing value. Thus, a mean of 0.984 suggests that 98.4% of the sample in wave 1, conditional on having sent some kind of response, is complete data. This does not necessarily imply that the respondent answered all questions completely, however.

Table 1 introduces the number of responses by wave. Wave 1 begins with 8041 individuals who underwent the middle-high school transition at some point in the dataset. Of these 8041 responses, 98.4% are complete; that is, both child and parent answered the survey.

For the other 1.6%, the responses are incomplete; either only child or only parent answered, or the data from that wave was excluded by the survey administrator. As households attrite from the dataset over waves, the number of observations decreases. In wave 7, we are left with 2710 observations, again 98.4% of which are complete. As a note, a portion of this attrition is due to the student graduating from high school, upon which they are no longer considered for the survey.

Table 2 explores the distribution of grades represented in each wave, conditional on a complete response. Within each wave, the proportion of responses from each grade is fairly uniform. Due to the requirement of the student having undergone the middle-high school transition at some point in the dataset, each wave only represents a particular band of grades.

Table 2

Summary of complete responses by grade across waves

	w1	w2	w3	w4	w5	w6	w7
Elementary 4	16.15						
Elementary 5	16.02	16.32					
Elementary 6	16.70	16.59	17.16				
Middle 1	16.83	16.03	16.17	16.92			
Middle 2	17.02	17.06	16.26	16.56	20.78		
Middle 3	17.28	17.69	17.63	16.89	20.33	27.00	
High 1		16.29	16.49	16.75	19.68	24.02	35.81
High 2			16.23	16.20	19.74	23.89	32.02
High 3				16.63	19.37	24.83	31.87
Not in school		0.03	0.05	0.05	0.10	0.26	0.30
N	7921	7293	6597	5857	4914	3834	2667

Note: Column percentages

Interpretation of Table 3 is unwieldy for most variables, as most are categorical variables reported in more than two categories. With that said, it is reassuring that the mean of binary *Female* is not significantly different from 0.5, as gender parity should hold in this sample.

Furthermore, from Table 3 it can be seen that about 2.6% of the sample (230 individuals) undergo a bad update from middle to high school.

Table 3

Summary statistics for key variables

	count	mean	sd	min	max
Selective aspiration, grade 9	8095	2.530327	1.035705	1	4
Selective aspiration, grade 10	6921	2.417425	1.025193	1	4
Bad update	8738	.0263218	.1600997	0	1
Female	8724	.503668	.5000152	0	1
Father's highest level of education	7177	3.802006	1.482039	1	6
Mother's highest level of education	7673	3.571745	1.169474	1	6
Household income	8129	5.569443	1.928822	1	10
Monthly investment in child	6830	5.727818	2.639046	1	10
Aspired level of education	5785	2.559205	.7254479	1	4
STEM track	7085	.6947071	.4605639	0	1
Japanese score	6859	3.420469	1.1794	1	5
English score	6860	3.413703	1.332794	1	5
Math score	6861	3.461886	1.276913	1	5
Science score	6855	3.435594	1.259531	1	5
Social studies score	6853	3.480228	1.255378	1	5
Observations	8738				

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

Estimation Strategy

I estimate regressions of the following general form

$$Y_{it} = \alpha + \beta D_{it} + \boldsymbol{\gamma} \boldsymbol{X}_{it} + \delta_t + \varepsilon_{it}$$

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, $\boldsymbol{X}_{it}$ is a vector of controls on household and individual characteristics, and δ_t is a set of time fixed effects.

Two main issues pose obstacles to estimating the causal effect of a bad update on students' aspirations. First, as seen in Table 3, the number of "treated" students who undergo the

bad update in the sample is low. While this raises a number of issues, standard errors tend to be large, and conventional inclusion of interaction terms or testing for heterogeneous treatment effects is difficult due to the even smaller number of treated students in each subgroup. Second, students endogenously select into treatment; that is, students who already have high aspirations are more likely to receive a bad update, purely because they have a high goal for high school advancement.

I attempt to address these issues through various strategies, such as coarsely matching on pre-transition aspirations, controlling for individual and time fixed effects, and constructing a synthetic control group for differences-in-differences regression. Estimates are checked for consistency across probit specification and interactions. With that said, without exogenous variation or quasi-randomness to exploit, it is difficult to fully causally interpret estimates in this study.

The main findings of this study utilize a coarse exact matching strategy (CEM), which addresses the imbalance in treated and control units by matching on "coarsened" strata (Iacus, King, and Porro 2012). Because it is of particular importance in this setting to retain as many treated units in the analysis as possible, CEM offers a way to match on parameters of interest and prevent too many treated units from being pruned. In general, matching offers the benefits of less dependence on the estimation model and reduced bias; CEM specifically limits the loss of treated units in this setting, where number of treated is already low. Using CEM to pre-process the data, we estimate an 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.

4. Results and Discussion

A. Main Results

As a baseline, I first estimate simple linear regressions in two-period fixed effects (unconstrained difference-in-differences) design. The regression takes the form of

$$Y_{i,post} = \alpha + \beta D_i + \eta Y_{i,pre} + \boldsymbol{\gamma X}_{it} + \varepsilon_{it} \quad (1)$$

which differs from the aforementioned general form by restricting to only two time periods, before and after the transition into high school.

Table 4

Baseline linear regression of post-transition selective aspiration

	(1)	(2)	(3)
Selective aspiration	0.215***	0.215***	0.220***
	(0.0151)	(0.0152)	(0.0154)
Bad update=1	0.147***	0.135*	0.251***
	(0.0398)	(0.0573)	(0.0699)
Female	-0.0537***	-0.0545***	-0.0538***
	(0.0148)	(0.0150)	(0.0148)
Bad update=1 # Female		0.0246	
		(0.0793)	
Selective aspiration # Bad update=1			-0.158
			(0.0846)
Constant	0.116	0.117	0.114
	(0.112)	(0.112)	(0.113)
Background controls	Yes	Yes	Yes
Academic controls	Yes	Yes	Yes
Observations	4375	4375	4375

Note: Background controls: household income, highest father and mother education, and monthly investment in child; academic controls: STEM/humanities track, and scores in school subjects. * $p < 0.05$, ** $p < 0.01$, *** $p < 0.001$

As expected, aspiration prior to the transition is highly predictive of post-transition aspiration, and females tend to have lower aspiration than males. However, in this model, undergoing a bad update is associated with a positive effect on aspiration to attend selective university. This result holds with probit and ordered probit specifications for the outcome. This seems counterintuitive – one would rather expect a bad update to depress aspirations – so further investigation is warranted. We also see in this model that standard errors are rather large due to the small number of treated units, highlighting the level of uncertainty around these estimates. These estimates are not to be taken as shown, but provide a reference point as methods to hone in on the true effect.

Table 5
Linear regression of post-transition selective aspiration, pre-matched on aspiration

	(1)	(2)	(3)
Selective aspiration	0.198***	0.198***	0.203***
	(0.0195)	(0.0195)	(0.0199)
Bad update=1	0.138***	0.134*	0.227**
	(0.0403)	(0.0587)	(0.0710)
Female	-0.0427*	-0.0430*	-0.0429*
	(0.0185)	(0.0188)	(0.0185)
Bad update=1 # Female		0.00774	
		(0.0807)	
Selective aspiration # Bad update=1			-0.135
			(0.0861)
Constant	0.205	0.205	0.201
	(0.188)	(0.188)	(0.188)
Background controls	Yes	Yes	Yes
Academic controls	Yes	Yes	Yes
Observations	3581	3581	3581

Standard errors in parentheses; * $p < 0.05$, ** $p < 0.01$, *** $p < 0.001$

Because one might suspect that the estimates are also biased upwards due to high-aspiration students endogenously selecting into treatment, I coarsely match on both selective aspiration and level of aspired highest education. The matching retains all treated units and all but 22 of the control units. We do observe estimates shrink slightly. Notably, there still does seem to be a positive effect on selective aspiration.

To better understand if the small positive effect we see should be attributed to unobservables that have not been controlled for, I now use all time periods in the data, not just two, to allow for an individual fixed effect denoted by λ_i. This captures time-invariant characteristics of the individuals, providing a better estimate robust to certain unchanging qualities of the individuals that may make them predisposed to updating their aspirations in certain ways.

$$Y_{it} = \alpha + \beta D_{it} + \boldsymbol{\gamma X}_{it} + \delta_t + \lambda_i + \varepsilon_{it} \quad (2)$$

Table 6
With time and individual fixed effects, pre-matched on aspiration

	(1)	(2)
Bad update = 1	0.0905***	0.0730*
	(0.0253)	(0.0364)
Constant	0.231	0.438
	(0.169)	(0.306)
Background controls	Yes	Yes
Academic controls	Yes	Yes
Time FE	Yes	Yes
Individual FE	No	Yes
N	20261	20261

Standard errors in parentheses
* $p < 0.05$, ** $p < 0.01$, *** $p < 0.001$

While statistical significance is robust to inclusion of two-way fixed effects, the remaining effect of a bad update is relatively small. Still, there is some evidence that a bad update, for those who undergo a bad update, has a positive effect on aspirations for selective school. To characterize for whom this positive effect should be interpreted, the following section explores heterogeneous treatment effects across gender.

The role of gender

The above tables thus far have allowed for interaction between gender and bad update, but no interaction coefficients have been significant. Again, the issue of low sample size rears its head: the number of students who have been treated in each gender is relatively low, about 100 for either gender. It is thus not implausible that we are unable to detect an interaction due to low power.

Table 7
Treatment effects by gender

	(1) male	(2) female	(3) male_weight	(4) female_weight
Bad update	0.112**	0.163***	0.0663	0.113**
	(0.0353)	(0.0357)	(0.0355)	(0.0360)
Constant	0.650***	-0.0296	0.554***	0.0102
	(0.0860)	(0.261)	(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	10398	9863	10394

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

To tentatively explore the validity of this claim, I compare treatment effects when restricting to only male or only female respondents respectively. Table 7 presents results with and without CEM.

As expected, CEM reduces the magnitude of estimates by addressing the endogenous selection issue. Even so, a positive effect appears to remain for female students, but not for male students. This may suggest that we lack the power to detect an interaction between gender and bad updating, even if heterogeneous treatment effects exist. Interestingly, if female students are largely driving the positive effect of a bad update, this would contradict the initial intuition that female students would be more negatively affected than male students.

B. Further exploration and discussion

Main findings can be summarized as such: undergoing a bad update is associated with a positive update in aspiration for selective university, and this positive effect may be driven by female students. Note that these results derive from estimates of the ATT, which means they should be interpreted for students who fail to get into their top high school.

As mentioned in the literature review, Bobba and Frisancho (2022) suggest that males and individuals of high SES have greater signal pass-through; that is, these subgroups weight the signal more heavily in forming their posterior. Interpreting a bad update as a signal of ability, female students in this case might be expected to not assign so much weight to a bad update. While the findings of Bobba and Frisancho (2022) might generally align with the empirical results in this paper, the positive effect of a bad update for female students would imply that female students receive the signal and internalize it in the opposite direction. Because a bad

update should nearly unequivocally be a negative signal on ability, it is puzzling that, rather than simply a null effect of ignoring the signal, students adjust their aspirations counter to the signal.

This section presents additional checks that offer limited, but exploratory, insight into our results. I tentatively explore why a bad update may confer an increase in selective aspiration, particularly for female students. Generally, the approaches in this section are severely limited by the two main issues of endogeneity and sample size, which is why they should be taken only for suggestive intuition. Other robustness checks (such as alternate model specifications for the main findings presented above) are not presented in this section, but are described in the appendix.

Alternate outcomes and treatment

Table 8
Aspired highest level of education, pre-matched aspirations

	(1)	(2)
badupdate_t=1	0.0450	0.0755
	(0.0485)	(0.0738)
Constant	2.008***	4.327***
	(0.595)	(0.354)
Background controls	Yes	Yes
Academic controls	Yes	Yes
Time FE	Yes	Yes
Individual FE	No	Yes
N	17514	17514

Standard errors in parentheses
* $p < 0.05$, ** $p < 0.01$, *** $p < 0.001$

First, I check the definitions of the variables in the main specification by repeating analysis with alternate outcomes and treatment. The first alternate outcome is the student's

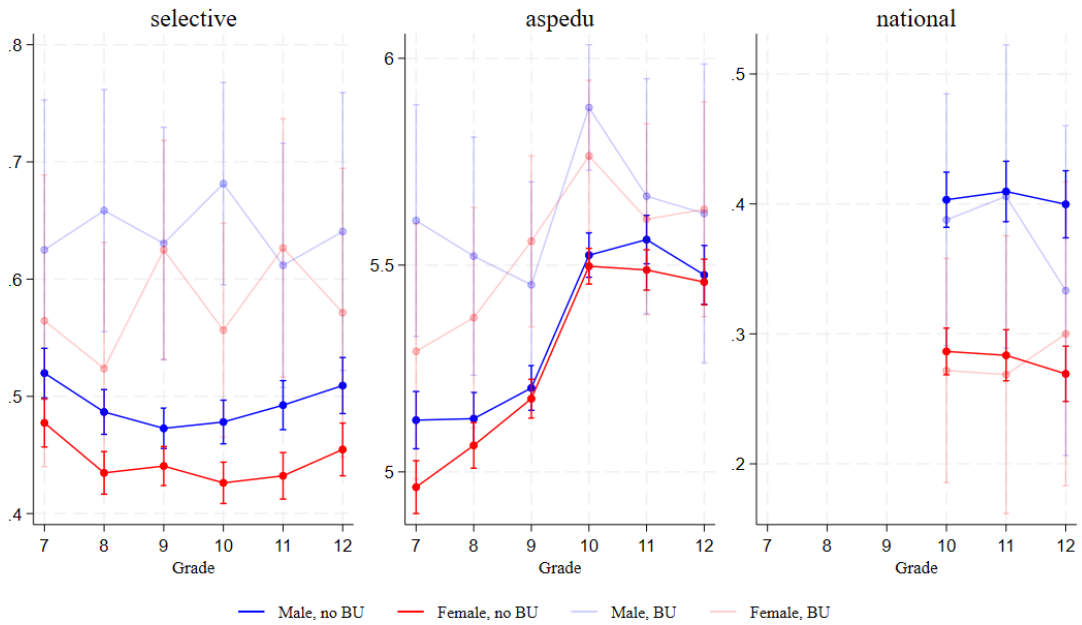
reported highest level of education that they aspire to achieve. Using the same approach as in the main findings in Table 6, which entails a two-way fixed effects regression with pre-matched aspirations, a bad update does not appear to have an effect on either aspiration. It would certainly be surprising if a disappointment in high school entrance had a large impact on aspiration for the level of education attained – for example, if a student decided to forego going to college entirely.

One might think that aspiration to attend national university should exhibit a similar trajectory as aspiration for selective university in general. An obstacle to testing the aspiration for national university is that it is not observed prior to the transition in this data; thus, the effect of the transition cannot be estimated. Attempts to impute by using pre-transition selective aspiration or by simply assuming all students are ambivalent (0.5 instead of 0 or 1) are uninformative and estimates are insignificant. Therefore, it appears that the particular outcome selected conveys some aspiration that is distinct from what is captured by aspired level of highest education and, potentially, though concrete conclusions cannot be drawn, aspiration for national university. For reference, Figure 2 on the following page presents the means of these three outcome measures over grades 7 to 12.

As for alternate treatment, the JLSCP introduces a question of "What is the most common post-graduation path of alumni at the high school you aspire to attend" in waves 6 and 7. Utilizing the existing question of "What is the most common path of alumni at the high school you are currently attending" I construct an ordered ranking of the "best" type of high school to the "worst": selective university, mid-tier university, and technical school/employment. A bad update is now defined as attending a high school whose type is lower than that which you initially aspired for. For example, if a student initially aspired for a high school whose alumni frequently attended selective university, but their actual placement in a high school has alumni

Figure 2

Mean outcomes over grades, by subgroup



Note: BU denotes that student will undergo a bad update between grade 9 and 10. (Left) Binary aspiration for selective school, outcome in main specification; (Center) Categorical aspired highest level of education; (Right) Binary aspiration for national university.

who frequently attend mid-tier universities, they would be classified as having undergone a bad update.

Limitations of this redefinition are that the question is only asked in waves 6-7, which means we require responses from students who were grade 9 in wave 6 and grade 10 in wave 7 to have both pre- and post-transition responses. This limits our analysis to only one cohort, and a simple two period unconstrained DID, similar to the baseline specification.

Table 9
Alternate treatment: worse type of high school

	(1)	(2)	(3)
Selective aspiration	0.188***	0.188***	0.168***
	(0.0376)	(0.0377)	(0.0443)
Alternate bad update=1	0.0679	0.0592	0.0337
	(0.0362)	(0.0539)	(0.0514)
Female	-0.0885*	-0.0934*	-0.0885*
	(0.0363)	(0.0432)	(0.0363)
Alternate bad update=1 # Female		0.0164	
		(0.0732)	
Selective aspiration # Alternate bad update=1			0.0643
			(0.0717)
Constant	0.271	0.273	0.294
	(0.277)	(0.277)	(0.276)
Background controls	Yes	Yes	Yes
Academic controls	Yes	Yes	Yes
Observations	753	753	753

Standard errors in parentheses
* $p < 0.05$, ** $p < 0.01$, *** $p < 0.001$

No effect is found with this redefinition. The absence of an effect perhaps implies that it is not the objective change in "quality" of school that the students attend that drives a positive update in aspiration. The key to interpreting this finding lies in the difference between not attending one's top choice of high school and attending a school that is objectively less prestigious. Furthermore, building upon the differences we see in the alternate outcome

measures, it seems that our specific treatment and outcomes depend on students' perceptions of ability and aspirations.

Multi-period DID and event study

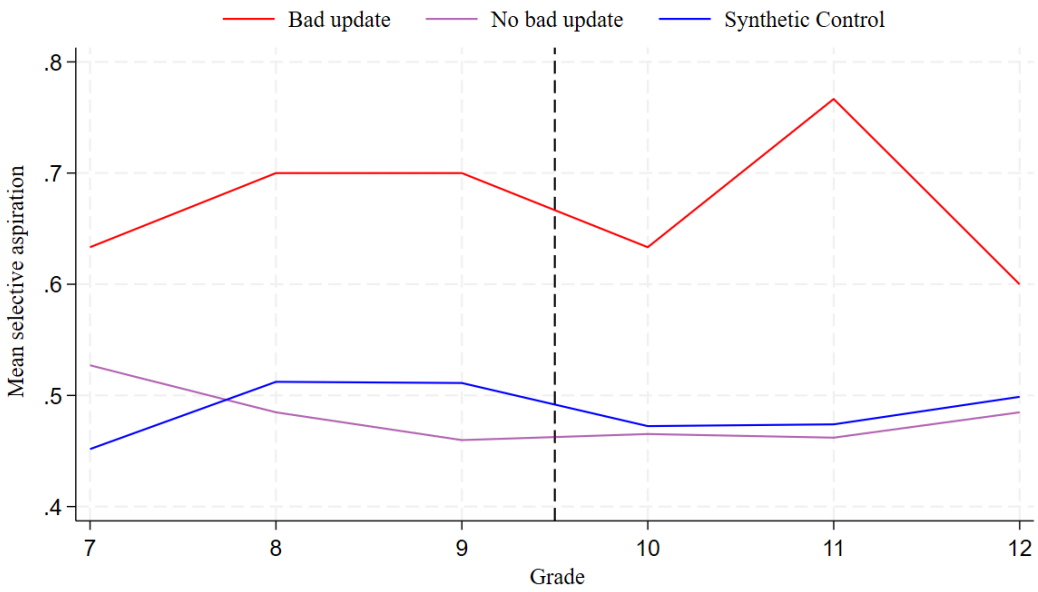
One might be interested in isolating the effect using a multi-period DID approach since the baseline estimates are fundamentally a variation on the classic DID method. After all, aspirations are likely to change in high school from year to year, so the effect of a bad update might also change from year to year, even after the transition has occurred. Once a student undergoes a bad update, they are generally "stuck" with that fact, and are thus treated forever – how might that treatment effect be evolving through high school? Discussion of these results is purely for explorative purposes, as the number of treated units who can be followed from grade 7 to 12 is far too low to draw any legitimate interpretation[3]. Standard errors are not shown in the figure, but should be taken as too large for causal interpretation.

As one might expect from previous discussion, we observe that the pre-transition trends of the treated and untreated are quite different, which clearly violates the parallel trends assumption of a DID method. (We also confirm that bad updaters tend to have higher aspirations than other students.) I thus construct a synthetic control to better enable comparison of post-transition aspirations between the treated and untreated groups (Abadie and and Hainmueller 2010).

[3] 15 out of 932 total students who can be followed for the 6 years from middle to high school

Figure 1

DID and Synthetic DID



The figures suggest that the positive effect of a bad update should be attributed primarily to grade 11 aspirations, in which bad updaters appear to raise their aspirations. The gap then closes in grade 12 back to about pre-transition differences. This finding could suggest students' several months of experience in their new schools shaping their aspirations. One could picture a student failing to get into their top choice, ending up attending a less competitive school, and suddenly enjoying being in the top ranks of their new school, then bolstering their hopes of attending selective university.

Students who marginally enter a school that is objectively less prestigious may enjoy a better rank than what they would have in their top choice. In this case, drawing upon literature on rank effects, Denning, Murphy, and Weinhardt (2023) find that students' ranks in elementary school impact long-run outcomes such as high school graduation and job earnings; their work

highlights the tradeoff between a school in which a higher rank can be attained and a school in which peers are higher achieving. They also find that disadvantaged groups gain more from being high-ranked, but lose more from being low-ranked (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 US is similar to that faced by women in Japan, heterogeneous sensitivity to rank effects may explain the heterogeneous gender effect found in this paper, where women react more positively to a plausible increase in rank relative to their counterfactual potential rank.

Characterizing bad updaters

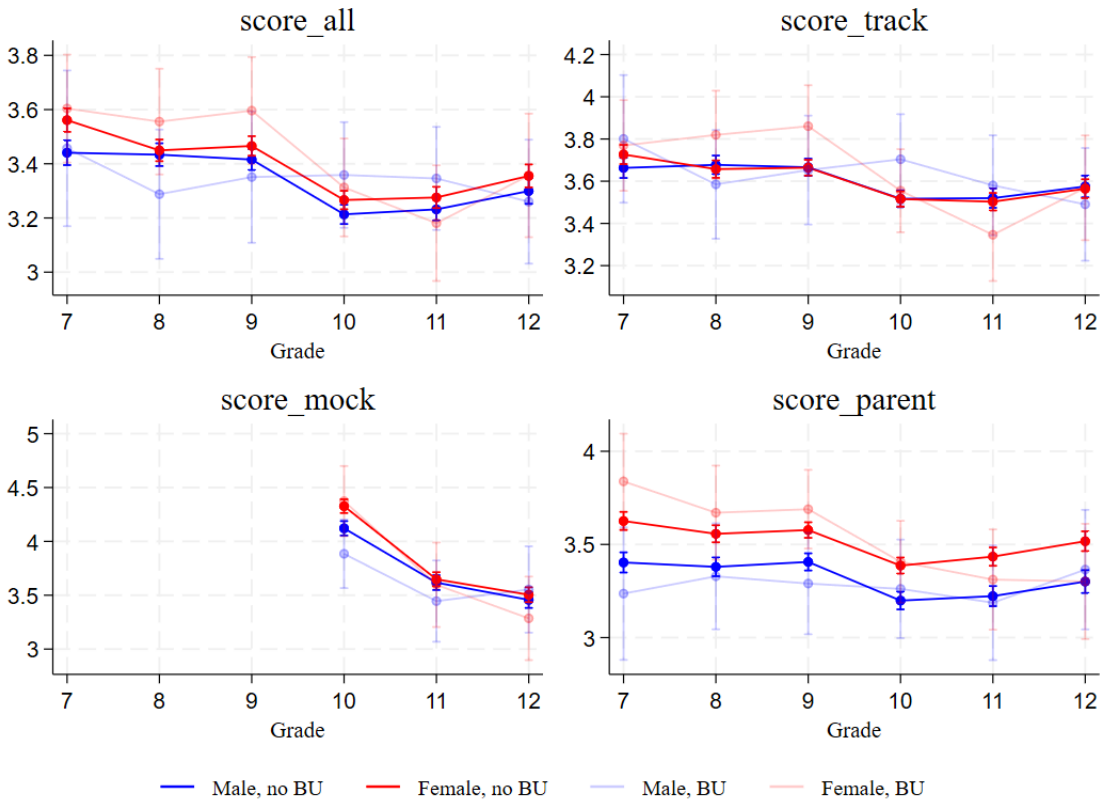
Figure 3 presents mean performance from grades 7 to 12. Prior to high school admission, female bad updaters are quite high performing, not only in general but also in their self-decided track. However, they appear to lose their performance advantage in high school. Two additional figures in the appendix, Figures A2 and A3, suggest that female bad updaters also consistently tend to receive more investment from their parents, particularly salient in years just before an admissions event (grades 9 and 12). They also tend to report more hours spent studying, and slightly more hours doing homework in high school.

Female bad updaters' diminished performance in high school seems to undermine the rank effects theory, as female students who enter not-so-good high schools appear not to have any performance advantage in this placement. It should be noted that rank effects need not arise from strict performance measures. Being in a less prestigious high school could, for instance, imply different class sizes, more or less interaction with teachers, and different social status for

those students. It seems unlikely that such changes would have large enough effects to generate a positive aspiration update, however.

Figure 3

Mean performance over grades, by subgroup



Note: All are reported in quintiles, i.e. Very above average, slightly above average, average, slightly below average, very below average. (Top left) Self-reported score averaged across all subjects; (Top right) Self-reported score averaged across subjects relevant to reported track; (Bottom left) Self-reported mock university admissions exam score; (Bottom right) Score reported by student's parent averaged across all subjects.

Another interpretation of female bad updaters' high performance prior to the update could be that these students are, to begin with, systematically different from female non bad updaters. Despite a setback in high school admission, they may have personal commitment to aspiring

high. For this group of individuals, the cost of placing heavy weight on a negative signal is very high: the sunk costs of higher parental investment and higher study hours may be perceived as too costly to renege on. If in contrast the returns to raising aspirations are positive, female bad updaters may rationally choose to raise aspirations in the face of a negative signal. One way this may manifest is in confidence, and the various utility and performance gains associated with overconfidence (Compte and Postlewaite 2004). In general, if we believe that female bad updaters are receiving the signal but choose to act against it, they may act under information processing biases.

Finally, we should also note that the original "bad update" definition hinges on students reporting *after* the transition whether their current high school was a top choice or not, such that students may adapt their definition of a top school after the transition. If students, for instance, tend to report a bad update when they are more satisfied in high school, estimates would be biased upwards. Suppose a student entered a high school that is not as challenging to succeed in as another. If experiencing this leads the student to report having not entered their top choice of school – perhaps the student enjoys being challenged – then the student may raise their aspirations as a result of being in a less challenging school, but still report a bad update. If we are capturing many such students, this could explain why we see a positive effect on selective aspirations from a bad update.

5. Conclusion

This paper finds that failing to get into one's top choice of high school is associated with increasing aspiration for selective university in Japan, and provides suggestive evidence that this

result is driven by female students. Causal interpretation is limited by endogeneity, though attempts were made to mitigate bias caused by endogeneity through matching methods and fixed effects.

Discussion of multi-period DID results, redefinitions of treatment and outcomes, and heuristic interpretation of other observables raises possible explanations for this counterintuitive result, but to more comprehensively understand the true mechanisms driving the results, further analysis focusing on what specific factors are included in students' aspiration functions could illuminate why entering a less desirable school would increase aspiration to attend selective university. If rank effects can explain some of the positive effect, then why are these students decreasing in performance, and how does that explain their positive update in aspiration? How do female students interpret a negative signal such as a bad update? The general equilibrium effects from the persistence of gender inequality in Japan may play a role in female students' response to signals.

Though there is no clearly correct mechanism that explains the positive effect found in this study, the result itself has implications for broader student decision-making and school choice. Students expressed a stronger desire to attend a selective university upon a bad update, which may call into question the expectations they had set prior to the transition. For example, perhaps the school that they were placed into was a better fit for nurturing their aspirations, and thus the student could have adjusted their top choices of high schools to target this outcome. Literature on school choice argues that better information on schools' value-added, as opposed to mean achievement, can improve student outcomes (Arteaga et al. 2022; Cullen, Jacob, and Levitt 2006). If different subgroups of students have different value-added across schools, then these subgroups could benefit from incorporating this value-added into their aspirations.

In a setting such as Japan, where education is extremely and 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.

Appendix

Table A1
Replication of main findings with additional controls

	(1)	(2)	(3)	(4)
Bad update=1	0.0811*	0.0844*	0.0844*	0.0844*
	(0.0362)	(0.0364)	(0.0364)	(0.0364)
Constant	0.384	0.370	0.370	0.374
	(0.314)	(0.298)	(0.298)	(0.299)
Background controls	Yes	Yes	Yes	Yes
Academic controls	Yes	Yes	Yes	Yes
Parent work status	Yes	Yes	Yes	Yes
Cram school attendance	No	Yes	Yes	Yes
Birth order	No	No	Yes	Yes
Track performance	No	No	No	Yes
Time FE	Yes	Yes	Yes	Yes
Individual FE	Yes	Yes	Yes	Yes
N	19294	19217	19217	19217

Note: Replicates model 2 of Table 6, two-way fixed effects over all time periods, with pre-matched aspirations. Additional controls: parental employment status, attendance of cram school, birth order, and academic performance in declared track (STEM/humanities). * $p < 0.05$, ** $p < 0.01$, *** $p < 0.001$

Table A2
Probit specification of Table 5

	(1)	(2)	(3)
At female = 0	0.128***	0.123*	0.137***
	(0.0350)	(0.0508)	(0.0360)
At female = 1	0.133***	0.138**	0.140***
	(0.0369)	(0.0508)	(0.0380)
Observations	3581	3581	3581

Note: Marginal effects from probit specification of Table 5, 2-period unconstrained DID, with pre-matched aspirations. (1) Basic with controls (2) Allow for bad update x female (3) Allow for bad update x pre-aspiration. Estimates are average marginal effects at female = 0 and female = 1. * $p < 0.05$, ** $p < 0.01$, *** $p < 0.001$

Table A3
Ordered probit specification of Table 5

	(1)	(2)	(3)
1.badupdate			
No selective aspiration # female = 0	-0.0484***	-0.0242*	-0.0563***
	(0.00597)	(0.00970)	(0.00658)
No selective aspiration # female = 1	-0.0542***	-0.0780***	-0.0625***
	(0.00675)	(0.00824)	(0.00747)
Not much selective aspiration # female = 0	-0.0440***	-0.0197*	-0.0403***
	(0.00669)	(0.00875)	(0.00751)
Not much selective aspiration # female = 1	-0.0403***	-0.0651***	-0.0348***
	(0.00633)	(0.00957)	(0.00709)
Some selective aspiration # female = 0	0.0109***	0.00713**	0.0225***
	(0.000734)	(0.00231)	(0.00306)
Some selective aspiration # female = 1	0.0179***	0.0209***	0.0290***
	(0.00155)	(0.000969)	(0.00366)
Very selective aspiration # female = 0	0.0815***	0.0368*	0.0741***
	(0.0122)	(0.0162)	(0.0128)
Very selective aspiration # female = 1	0.0765***	0.122***	0.0683***
	(0.0116)	(0.0175)	(0.0121)
Observations	25590	25590	25590

Note: Marginal effects from probit specification of Table 5, 2-period unconstrained DID, with pre-matched aspirations. (1) Basic with controls (2) Allowing for bad update x female interaction (3) Allowing for bad update x pre-aspiration interaction. Estimates are predicted probabilities at female = 0 and female = 1 and levels of selective aspiration, 1 being the least and 4 being the most.
* $p < 0.05$, ** $p < 0.01$, *** $p < 0.001$

Table A4
ATT estimates from DID and synthetic DID

	Coef	St err
DID	0.0042974	0.0025532
Synthetic DID	-0.001588	0.0025352

Note: Standard errors produced by 200 bootstrap repetitions

Figure A1

Event study estimates

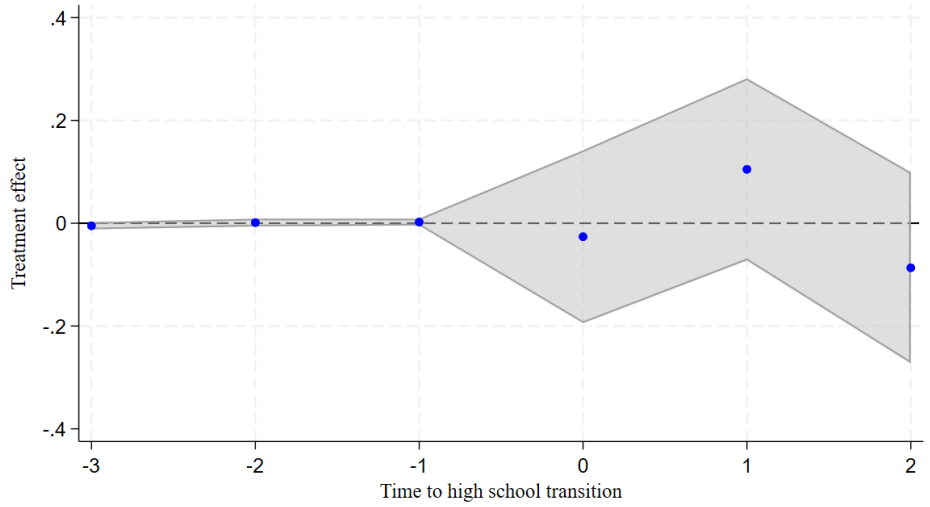
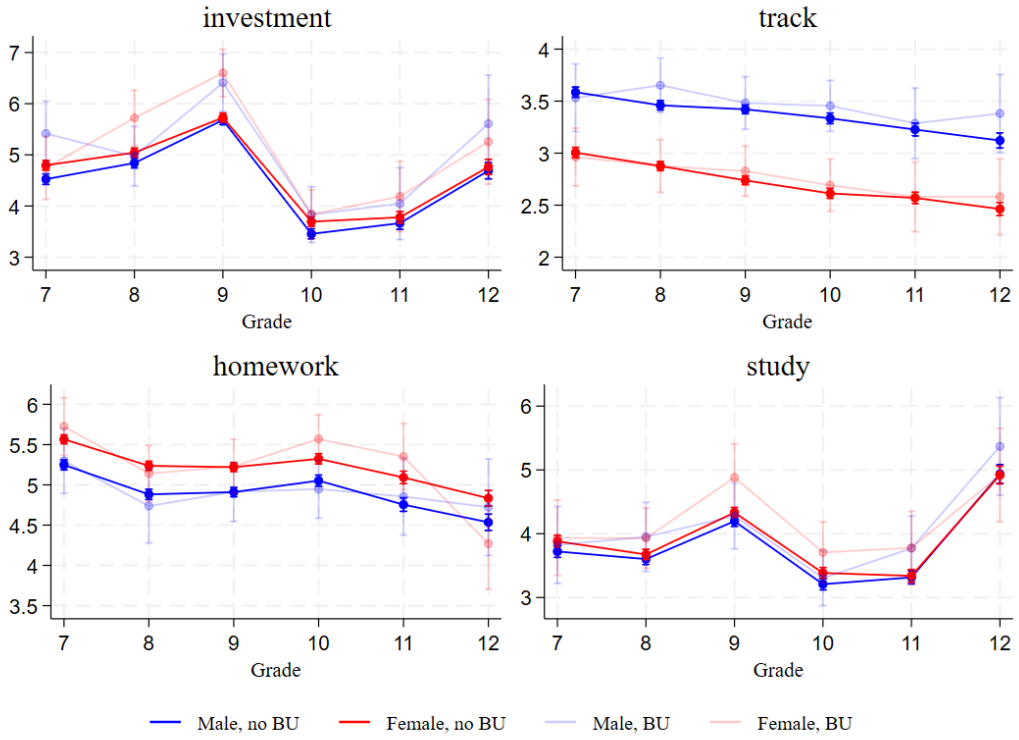


Figure A2

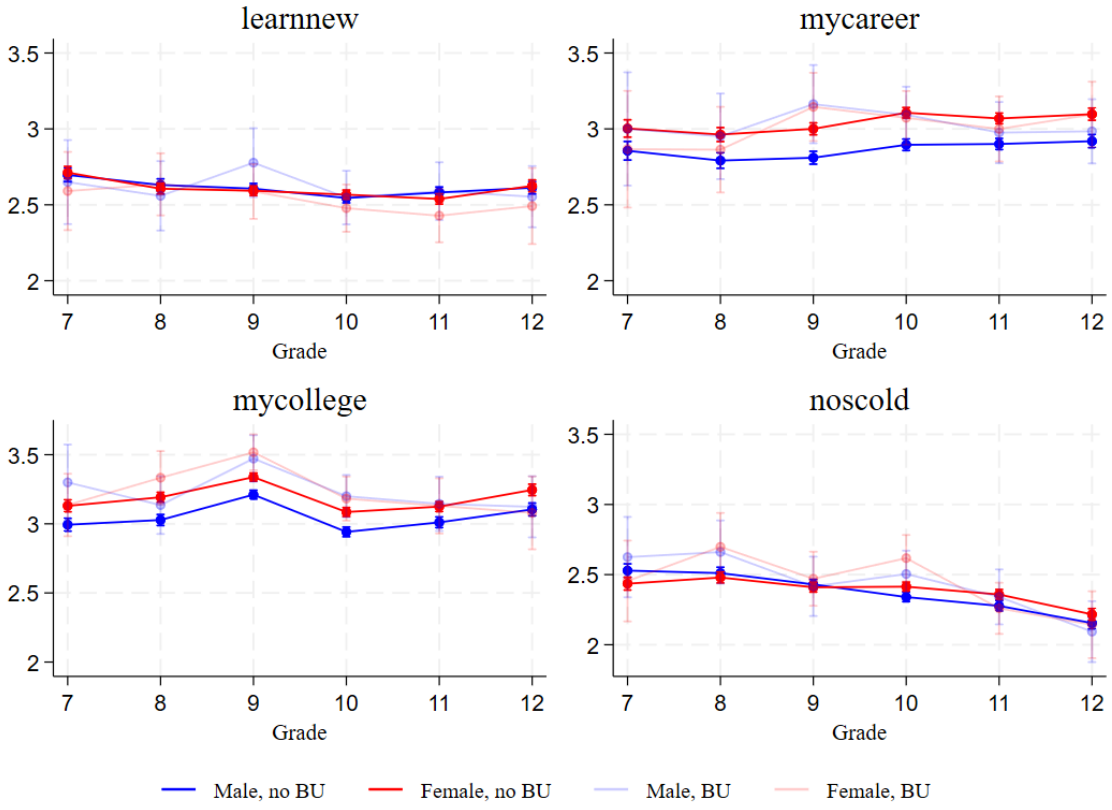
Additional characterization of bad updaters



Note: (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.

Figure A3

Academic motivations



Note: Categorical responses to the following academic motivations: (Top left) Happiness from learning new things; (Top right) To achieve the career I want; (Bottom left) To go to the high school/college I want to go to; (Bottom right) To not be scolded by teachers or parents.

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