Should school-level results of national assessments be made public?

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Abstract

How national standardized assessments should be designed has been debated extensively. This paper contributes to this debate by examining empirically how the public disclosure of information on school-level assessment scores impacts student outcomes. To this end, we highlight the policy reform in Japan in 2014, whereby the Ministry of Education granted each municipality the discretion to decide whether to make assessment results of each school within the municipality public. Utilizing the resulting variations in the information disclosure system across municipalities, we show that the disclosure of school-level test scores increases students' average test scores, *without* increasing the dispersion of individual scores among students. Inspecting the mechanism, schools under accountability pressure make better use of diagnostic information from assessments to improve teaching quality. Analysis further reveals that publishing school-level results could also enhance students' non-cognitive skills.

Keywords: National assessments, Student outcomes, School-level results, Information disclosure, School accountability
JEL: D80, I20, I28

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1 Introduction

National assessments are common across the world. For example, OECD (2015) report that 32 out of 38 OECD (and partner) countries conducted national assessments, a type of standardized student achievements tests which do not affect students' progression through school or certification, at the primary education level in 2015.[1] While their main purpose is to raise student achievements, say, by providing student diagnostic information with schools, a closer look reveals that there are substantial *variations* in how they are conducted. Those variations across assessments span various aspects, including the proportion of students who participate, the range of subjects covered, and the frequency at which tests are conducted. In this paper, we highlight one key variation on the *level* of assessment results which are made available to *the public*, and investigate how this variation affects student outcomes.

To clarify, with national assessments being mainly used as a diagnostic tool, schools and parents are usually informed of results of their students and a result of their child, respectively. However, a country has to make a decision as to the level of the aggregation of assessment results shared with the public (and media). While in theory the information shared could be at the level of country/state, province/prefecture, municipality, school, or even an individual student, an extensive debate has surrounded whether *school-level* results should be made public. This controversy is reflected in the state where there are a mixture of countries which disclose school-level results and which do not. For instance, the aforementioned OECD (2015) indicates that at the primary education level, only 14 of the OECD countries (e.g., Australia, Chile, Netherlands) using national assessments published results at the school level, while essentially all of them did so at the country level.

Various rationale for and against sharing school-level results with the public have been put forward (see Rosenkvist (2010) for useful survey). To illustrate, arguments *for* it include 1) increased transparency enhances school accountability, 2) enhanced accountability, in turn,

[1] As another type of a standardized test, OECD (2015) define national *examinations* as the ones which have a formal consequence for students, such as an impact on a student's eligibility to progress to a higher education level or to complete an officially-recognized degree.

may improve school management, and 3) competition across schools may promote teaching quality. Meanwhile, arguments *against* it include 1) competition may creates bias towards teaching for tests, 2) it is difficult to ensure the sound usage of information by the public, and 3) a possibly ill-informed school ranking could be established. This debate on a possible trade-off also applies to the case of Japan, a country featured in the following analysis. For example, a survey by the Ministry of Education, Japan (MEXT (2013)) shows that in 2013 there was a stark disagreement among local education policymakers on the desirability of school-level national assessment results being public.[2] There, a popular argument for it was that it helps a local authority be accountable for the performance of schools it manages, whereas a key argument against it was that it could be used inappropriately to rank schools.

To contribute to this debate, this paper investigates empirically how the public disclosure of school-level results of national assessments affects various student outcomes. To this end, we use sixth-grade student-level data from the national assessment in Japan (called National Assessment of Academic Ability). The main reason why the Japanese data, which span the 2007-2018 period, is useful in the current context is that the policy reform in 2014 granted each municipality an authority to decide whether to make results of national assessments public at the school level (there are 1,718 municipalities across Japan).[3] Until the reform, the only officially-published information on national assessment results was the one at the country and prefecture level (there are 47 prefectures), while the reform immediately led 136 municipalities to make school-level average scores of each subject publicly available. Our estimation exploits the resulting variations in the information disclosure system across municipalities, highlighting the case of Saitama prefecture.[4] The secondary reason why Japanese data are useful is that information on national assessment scores is accompanied by students' as well as schools' responses to various survey questions. This set of information allows us

[2]The official name of Ministry of Education, Japan is Ministry of Education, Culture, Sports, Science and Technology, Japan (MEXT).

[3]There was no assessment in 2011, the year in which the Great East Japan Earthquake struck.

[4]The reason why we focus on Saitama prefecture is elaborated below.

to consider channels through which the reform affected student outcomes, and also how it affected not only cognitive but also non-cognitive skills of students.

Our results are summarized as follows. First, the public provision of school-level assessment results *increases* the average test scores of students who attend schools whose results are made public. This result holds regardless of the subject (Japanese and Mathematics) and also the contents (basics and applications). Inspecting the mechanism, schools whose results were made public indeed become more *accountable*, and explain their performances better to the public. This increase in school accountability then coincides with the better use of diagnostic information from assessments to improve teaching quality. Next, analyzing possible trade-offs of the information disclosure, we investigate the possibility of students with poor performance being left behind. We find that the within-school variance of test scores rather *falls* particularly when contents of assessments are basics, suggesting that it is poorly-performed students' scores which increase relatively more. Further, we examine the impact on students' non-cognitive skills, to check if the improved test performance might be offset by an adverse impact on them. Results show that there are *no* such adverse effects, and there are even some positive impacts, for example, on students' self-confidence. On balance, therefore, our results indicate that publishing school-level results may be a good design feature of national assessments, at least from the perspective of student outcomes.

This paper is related to a number of works which analyze the role of large-scale (not necessarily national-level) assessments as an accountability intervention tool. That is, while the main use of such assessments is often to provide schools with student diagnostic information, they can also be used to enhance school accountability. The most explicit way to achieve this would be to link poor student achievements to punitive measures on schools. In this context, Rockoff and Turner (2010) find that grading each school based on student tests and linking it to rewards and punitive measures led to a swift significant increase in student achievement in lowly-graded schools in New York City. Rouse et al. (2013) show that in Florida, schools facing accountability pressure changed their instructional practices,

which, in turn, contributed to their gains in test scores.[5] These results are further echoed by a finding of other works that school accountability improves average student achievement in US states, as summarized in Figlio and Loeb (2011).[6]

Also, there are papers which shed light on the role of information provision (rather than explicit punitive measures) as an accountability-inducing device. For example, Andrabi et al. (2017) find that in Pakistan information provision of school test scores increases subsequent test scores, while increasing enrollment rate and reducing school fees. Camargo et al. (2018) show that in Brazil the disclosure of school-level test results has a positive impact on student performance only in private schools. Their interpretation is that this happens because only school managers of private schools are subject to market incentives in the country. Further, Koning and van der Wiel (2012) show that in Netherlands the publication of relative quality ratings of secondary schools in a national newspapers increases test scores, particularly at the lower support of performance distribution. Other papers such as Hastings and Weinstein (2008) and Koning and van der Wiel (2013) rather emphasize how information provision of school performances could affect parents' (and students') school choices in North Carolina, US, and Netherlands, respectively.[7]

Further, while this paper shows that the public disclosure of school-level test results leads to an increase in the average test scores in Japan, we also examine whether this positive impact is offset by promoting inequity among students. In relation to this, some papers investigate how the accountability inducing nature of large-scale assessments impacts the distribution of student achievements. Dee and Jacob (2011), for example, examine the effects of No Child Left Behind (NCLB) Act on the distribution of student achievements, and find mixed effects depending on subjects and grades. Ahn and Vigdor (2014), considering

[5] Chiang (2009) also examines the mechanism through which accountability pressure affects student outcome, showing, for instance, that sanction threats raise school spending on instructional technology.

[6] Early related works include Hanushek and Raymond (2005), who show that while accountability matters for student achievements in the US, attaching consequence to performance has a particularly positive impact on achievement.

[7] Mizala and Urquiola (2013) examine whether information on schools' value added, rather than absolute outcomes, affects parents' school choices and schools' market outcomes in Chile, and find that it does not.

the impact of sanctions incorporated into NCLB on students, find that while sanctions particularly for low proficiency benefit lower-performing students, they do *not* result in countervailing negative effects on higher-performing students. We also examine the possibility that disclosing school-level results may prompt schools to be negligent in caring for student outcomes beyond test scores, i.e., non-cognitive skills. This aspect of our paper is similar to Blazar and Kraft (2017), who consider teachers' impacts on students' test scores, together with impacts on non-cognitive skills.[8]

Overall, this paper contributes to the debate on the design of national assessments, by investigating the impacts of disclosing school-level results on a range of student outcomes, including the average test scores, the distribution of scores, and students' non-cognitive skills. The rest of the paper is organized as follows. Section 2 explains the background of the paper, highlighting the educational policy reform in Japan in 2014. Section 3 explains the empirical methodology, and Section 4 describes the data. Section 5 presents results. Last, Section 6 offers concluding remarks.

2 Background: Reform on national assessment in Japan

To explain details of the policy reform in 2014 on information disclosure of national assessments, we first briefly review 1) how national assessments have been conducted in Japan, and 2) how in general education policies are implemented at the local government level.

In Japan, national assessments have been conducted annually since 2007 in April each year, targeting 6th and 9th grade students (the last years of elementary and junior high schools, respectively).[9] All students all over Japan (about 1.1 million students in each grade as of 2017) participated in them, except for 2009, 2010, and 2012 when random sampling of students (about 30%) took part. In 2011, however, the assessment was canceled altogether

[8] Blazar and Kraft (2017) call non-cognitive skills attitudes and behaviors.
[9] Official name of the assessments is National Assessment of Academic Ability.

due to the impact of Great East Japan Earthquake.[10] While the subjects assessed changed year by year, Japanese and Mathematics have always been assessed for both grades.[11] Further, to assess separately students' understanding of basics and their ability to apply them, subjects are divided into two components of basics and applications.

While the Ministry of Education implements education policies which are applicable throughout Japan, local governments are given a high degree of discretion, creating a wide variety in the education system across them. One key feature of education policies at the local level is that governors of 47 prefectures and mayors of 1,718 municipalities (which are subordinate to prefectures) are not given an authority to conduct them on their own. Instead, the board of education (BoE), an executive body of (usually) 5 members in each of prefectures and municipalities, are responsible for designing and then implementing all the education policies such as the establishment and abolishment of public schools, the appointment and allocation of teachers, and the selection of textbooks.[12] Accordingly, an education policy announcement from the central authority of the Ministry of Education is made to the BoEs at the prefecture-level, and then to the ones at the municipality level.

In November 2013, the Ministry of Education announced to BoEs that rules on information disclosure of national assessments (National Assessment of Academic Ability) would be changed from assessments conducted in April 2014. The key contents of this reform are that it granted BoEs at the municipality level an authority to decide whether to make school-level results of national assessments (within the municipality) available to the general public, whereas BoEs at the prefecture level were allowed to make municipality-level results (within the prefecture) publicly available. In contrast, until the previous assessments implemented in April 2013, BoEs at the municipality level only had an option to disclose the municipality-level assessment results of their own, while prefecture-level BoEs were obliged to publish

[10] In 2016, students in the area of Kumamoto (a prefecture located in the Kyushu region, a south part of Japan) did not participate, due to the major earthquake happened in the area.

[11] In some years, natural science was also assessed.

[12] This does not mean that governors and mayors do not have any influence on education policy making, since they are responsible for budget execution of education policies in conjunction with other public policies.

their own prefecture-level results without an option of publishing municipality-level results. Thus, the bottom line of this reform was that BoEs were given an authority to disclose more disaggregated information on national assessment results to the public.

In what follows, we focus on the impact on student outcomes of the options granted to municipality-level BoEs on *the publication of school-level results*. As an important clarification, note that there are two alternative ways of making school-level results public. The first is that municipality BoEs could publish assessment results of schools under their supervision altogether in one place, say, on their own websites. And, the second is that they could instruct schools under their supervision to publish their own results, say, on their respective school websites. According to the survey conducted by the Ministry of Education in November 2014, the reform prompted 32 municipality BoEs across Japan to publish school-level average scores by subjects, and led 104 BoEs to instruct schools under their supervision to make them public. We below exploit these resulting variations in the information disclosure system across municipalities within a prefecture called Saitama, to estimate the impact of publishing school-level assessment results on student outcomes.

3 Empirical methodology

Our benchmark model for empirical analysis is the following:

$$\begin{aligned} Y_{ismt} = \beta_0 + \beta_1 T_m + \beta_2 After_t + \beta_3 (T_m * After_t) + X_{ismt}\,\gamma_1 + Z_{smt}\,\gamma_2 \\ + E_{mt}\,\delta + \epsilon_{ismt}, \end{aligned} \tag{1}$$

where Y_{ismt} represents test result of student i in school s located in municipality m in year t. In the right hand side, T_m is a treatment dummy which takes the value of one if in municipality m school-level results are published after 2014, the year of the reform. $After_t$ is a year dummy variable, taking the value of one in years after 2014. X_{ismt} is a vector containing variables reflecting student's home environment. In turn, Z_{mst} are variables related to a

school environment. Last, E_{mt} contains a various types of municipality education expenditure per student averaged over past 3 years. We include three-year average of municipality-level education expenditure since education spending from the third to fifth grade may particularly matter for educational outcomes measured by test scores in sixth grade. Our main focus below is the coefficient on the interaction between the treatment and after-reform dummies. If disclosure of school-level information improves test results, $\beta_3 > 0$.

Our identification strategy builds on the difference-in-differences estimator with the regression equation above (Eq.1). Identifying assumption for the effect of disclosure of school-level information on test scores is that the treatment status T_m is uncorrelated to the error term ϵ_{ismt}. One justification for the exogeneity of T_m is that the treatment status is determined by the board of education of municipality, and thus the decision of disclosure of school-level information is exogenously determined from the viewpoints of students and schools. However, municipality-specific unobserved factors correlated to the treatment status may affect student-level test scores. To account for this potential threat for identification, we control school fixed effects capturing the effect of time-invariant municipality-specific unobserved heterogeneity. In addition, although we calculate standard errors clustered at school level in the benchmark case, we calculate standard errors clustered at municipality level too as a robustness check, and account for the potential correlation of time-varying shocks across years and schools within municipality. Moreover, as a test of the identifying assumption with a difference-in-differences estimator, we test a parallel trend assumption by conducting event study analysis.

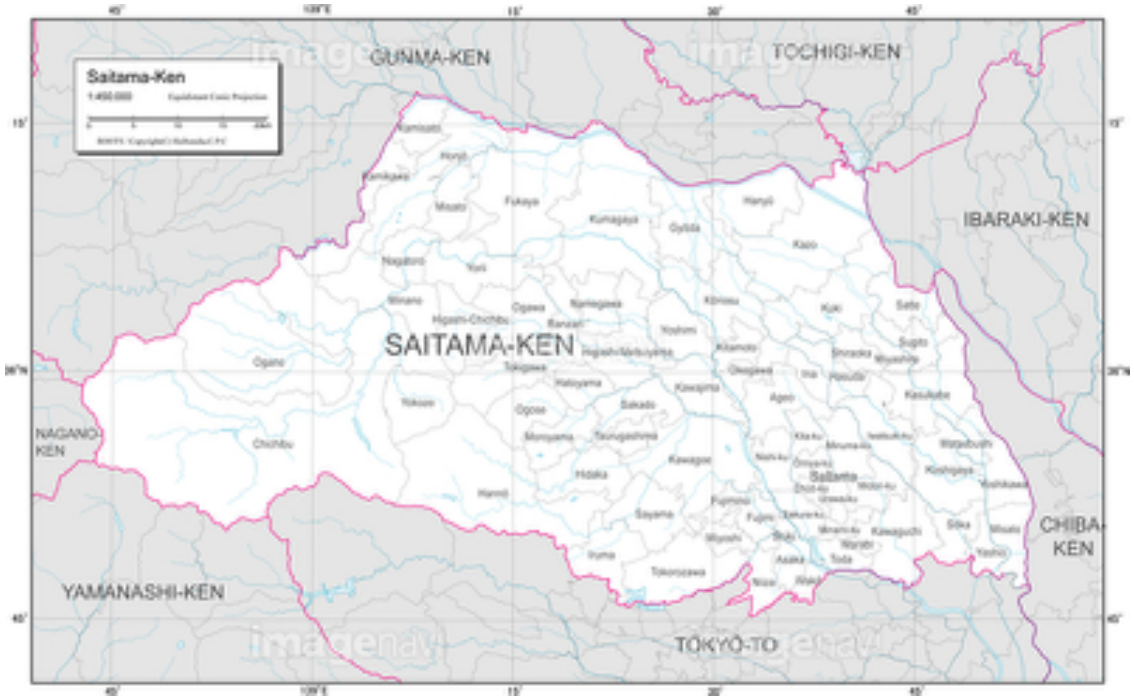
4 Data

Our fundamental data source is student-level data of the National Assessment of Academic Ability, Japan's ongoing national assessment. As mentioned, this assessment has been conducted annually since 2007 in April each year, targeting all 6th and 9th grade students,

except for 2009, 2010, and 2012 when random sampling of students (about 30%) took part and 2011 due to the Great East Japan Earthquake. We use student-level information of Japanese and Mathematics test scores, together with students' responses to questionnaire covering various aspects of 1) home environment, 2) studying behavior, and 3) non-cognitive traits. Student-level test scores are available for Japanese and Mathematics, both of which are further divided into scores on "basics" denoted as A (e.g., Japanese A) and "applications" as B. Assessments are also accompanied by school questionnaires which covers various aspects of school environment such as the class size, the proportion of students receiving school financial assistance (for students from low-income family), and the composition of teachers with different years of experience.

We focus our analysis on 6th grade students in public primary schools in cities of Saitama prefecture (population is about 7.3 million, the fifth-largest prefecture of Japan; Figure 1). The reason for this choice is at least threefold. First, because education policies including the recruitment and allocation of teachers within a prefecture is conducted by the board of education (BoE) at the prefecture (not municipality) level, focusing on one prefecture ensures the homogeneity of education policies implemented at the prefecture level. Second, the availability of the student-level data is relatively high in Saitama. To explain, before we asked for a permission from the Ministry of Education to use the student-level results of the national assessments for this research, the Ministry had to ask first for a permission from municipality BoEs all over Japan, to let the data to be used for research purposes (including ours). In the end, a substantial proportion of them (almost 70 percent) did not allow their data to be used (by researchers) *with their municipality name revealed*. This means that for those municipalities, it is not possible to match with the treatment status of disclosure of national assessment results. *However*, the majority of municipality-level BoEs in Saitama prefecture agreed to provide data with their municipality names revealed, facilitating our research: 33 out of the total of 40 cities within the prefecture agreed (82.5 percent, much higher than the national average of 30 percent). Third, we focus on students in public primary

Figure 1: Saitama ken (prefecture), Japan



schools in Saitama, because a *school choice* is rarely allowed for them. This means that by default students are supposed to attend schools within their respective residential areas. Hence, by focusing on students in public primary schools in Saitama, we can study the effects on student outcomes of the disclosure of school-level test results, independent of the effects caused by possible endogenous movements of students due to the information disclosure.

To gauge the level of the aggregation of assessment results shared with the general public in each of the 40 cities in Saitama, we conducted a survey to the BoE in each of those cities.[13] As noted, among the total of 40 cities, 7 cities did not agree to provide student-level data with us through the Ministry of Education. Also, we exclude Saitama city (the capital city of Saitama prefecture) from our sample, because it is a government-designated city where the BoE enjoys an even higher level of discretion of education policy than BoEs in other cities. This leaves 32 cities available for this research with their municipality names revealed. Since our own data collection effort (on the level of aggregation of assessment results being

[13]Municipalities in Japan consist not only of cities but also towns and villages. However, this paper focuses on cities, because towns and villages are small in size by definition, and the number of schools within them is thus quite small relative to cities.

made public) is ongoing, our baseline dataset currently consists of 19 cities for which the information of treatment status is available by now (as of September 2019). Focusing on assessments for 6th-grade students in these 19 cities from 2007 to 2018, observations are up to 188,685 students.

In our analysis, treatment cities are defined as cities where school-level information of the results of national assessments is available to the public after 2014. As emphasized, there are two types of cities in a treatment group. We call treated cities as *Type 1* if (municipality-level) BoE publishes on their website the list of school-level average test scores by subjects. We categorize Chichibu city and another city (call it X) in Type 1 treatment group.[14] We call cities as *Type 2*, if the BoE instruct schools under their supervision to publish school-level scores on their respective school websites. We categorize Okegawa, Fukaya, and Sayama cities as Type 2. The remaining 14 cities are cities where school-level information is *not* available to the public throughout the sample period, thus categorized as a control group. In the benchmark analysis below, we use only Chichibu, city X, and Okegawa as a treatment, leaving Fukaya and Sayama out of our sample. This is because we could not verify the claim of Fukaya's BoE that they instruct all the public schools to publish their results on their school websites.[15] On Sayama city, the BoE could not confirm with us in which year they started disclosing information on school-level results. That is, it has to be after 2014 (the year of the reform), but they could not specify when. All in all, therefore, the following analysis (at least in this version of the paper) covers 3 treatment cities and 14 control cities. To note, however, key results below are robust even when Fukaya and Sayama cities are included as a treatment.

We use data on education spending per student (decomposed into various components of consumption and capital spending) in each municipality for each year, taken from the School Basic Survey conducted by the Ministry of Education. Controlling for the detailed information on education spending is useful, because even if student outcome improved in

[14] When we interviewed the BoE of city X, they asked us to keep their name anonymous.

[15] We only managed to confirm the availability of school-level results for 5 out of 19 schools in Fukaya city.

Table 1: Summary statistics

Variable	Mean	Std. Dev.	Min.	Max.
Score_jpnA (standardized)	49.83	9.94	-3.9	68.09
Score_jpnB	49.8	10.01	17.39	71.02
Score_mathA	49.33	10.07	4.58	65.81
Score_mathB	49.61	9.85	20.45	74.61
Eat breakfast	2.87	0.45	0	3
Wake up at regular time	2.55	0.67	0	3
Sleep at regular time	2.23	0.81	0	3
Attend cram school	0.46	0.5	0	1
Receive financial support	10.31	7	0	52.5
Class size in previous academic year	32.36	5.32	1	45
Prop of teachers with exp under 5yrs	30.53	13.47	0	100
Consumption spend (per student, 1,000 yen)	129.6	22.42	84.5	212.36
Captial spend (per student, 1,000 yen)	84.64	84.5	3.4	570.22
observations		up to 164,920		

Notes: All test scores are standardized at a national level.

treatment cities after 2014, it does not necessarily mean that it is due to the reform on information disclosure of national assessments. That is, by controlling for how education spending is conducted in each municipality, we can control for the effects of a change in education policies which are accompanied by a significant change in spending in certain components.[16]

Summary statistics of the sample is reported in Table 1. All test scores are standardized within subject and year at national level with the mean of 50 and the standard deviation of 10. The average of all scores are slightly lower than 50, meaning that the average test score in our sample is lower than the national average. Regarding home environment of students, a majority of students have breakfast every morning, and wakeup and sleep at regular time on weekdays. 46 percent of students use some kind of cramming education services out of school. As information of school environment, about 10 percent of students received school financial support on average. The average class size of the fifth grade in the previous year, which is relevant as a possible determinant of test scores in the assessment taking place in the first month (April) of the sixth grade, is about 32. The proportion of teachers with

[16]For instance, if new computers are bought (or a new building is built) for students in certain municipalities, they are reflected in a rise in capital education spending component in those municipalities.

teaching experience less than 5 years is 31 percent on average. As the municipality level information, the average amount of consumption spending per student (an average of the past three years) is about 130,000 JPY (1200 USD). Similarly, capital spending is about 85,000 JPY (786 USD).

5 Results

5.1 Impact of information disclosure on test scores

5.1.1 Baseline results

Table 2 summarizes the estimates of the coefficient on the interaction term between the treatment dummy and the after dummy (i.e., difference-in-differences estimates; β_3 in Eq.1) for each subject (i.e., Japanese and Mathematics) and the content (i.e., A and B). Column 1 is for the estimates of the effect of information disclosure by regressing each test score without control. All coefficients are statistically significant at 1 percent level. The magnitude of the coefficients ranges from 1.144 (Mathematics B) to 1.394 (Japanese B). For example, the coefficient for Japanese A implies that test score of Japanese A of 6th grade students in public primary schools of treated cities increased by 1.334 points (i.e., 0.1334 standard deviation) compared to those in control cities after the disclosure of test results in treated cities (i.e., after 2014). The effects are larger for Japanese than mathematics.

The estimates reported from the second to fifth columns are ones with different sets of controls. We sequentially add controls of year fixed effects (Column 2), student-level home environment variables (Column 3), variables of school environment (Column 4), and school fixed effects (Column 5). The estimates are stable regardless of the specification, and all remain statistically significant at 1 percent level. These results indicate that the positive effects of information disclosure are robust to the inclusion of a battery of controls including school fixed effects.

Table 2: Coefficients on interaction between treatment and after-reform dummies

Dependent var.	(1)	(2)	(3)	(4)	(5)
Japanese A	1.334***	1.251***	1.228***	1.234***	1.308***
	(5.092)	(4.790)	(4.679)	(4.732)	(5.660)
Japanese B	1.394***	1.330***	1.306***	1.313***	1.126***
	(6.106)	(5.719)	(5.539)	(5.529)	(5.052)
Mathematics A	1.167***	1.114***	1.095***	1.133***	0.776***
	(5.030)	(4.757)	(4.751)	(4.870)	(3.166)
Mathematics B	1.144***	1.056***	1.035***	1.031***	0.881***
	(4.938)	(4.444)	(4.343)	(4.354)	(3.934)
Year fixed effects	No	Yes	Yes	Yes	Yes
Student environment	No	No	Yes	Yes	Yes
School environment	No	No	No	Yes	Yes
School fixed effects	No	No	No	No	Yes
Observations			164,920		

Notes: Difference-in-differences estimates of β_3 (cf. Eq.1). Robust t-statistics in parentheses. Clustered standard errors are used to adjust for correlation of error terms within school. *** $p < 0.01$, ** $p < 0.05$, * $p < 0.1$.

5.1.2 Robustness checks

Focusing on borders of treated and control cities In the baseline results reported in Table 2, we categorize all schools in treated cities in the treatment group and all schools in control cities in the control group. However, comparison of schools located distantly may suffer from confounding factors correlated to both test scores and municipality's characteristics. Thus, a cleaner comparison may be achieved by comparing schools in adjacent school districts across borders of treated and control cities. As a robustness check, we restrict our sample to students in schools located in adjacent school districts across borders of treated and control cities. Column 1 of Table 3 reports the estimates of the effect of information disclosure using the restricted sample of schools in adjacent school districts. They follow the specification in Column 5 of Table 2 (i.e., with school fixed effects). Results show that the benchmark results are robust to using data on students attending schools close to the border. Interestingly, the coefficients are even larger than those reported in Table 2.

Table 3: Robustness checks (based on a model with school fixed effects)

	Only borders	Control past municipality avg	Control past school avg
Japanese A	2.474***	1.286***	1.268***
	(5.036)	(4.947)	(3.973)
Japanese B	1.390***	0.860***	0.988***
	(3.277)	(3.594)	(3.608)
Mathematics A	1.452***	0.542**	0.480
	(3.116)	(2.005)	(1.638)
Mathematics B	1.432***	0.867***	0.790***
	(3.573)	(3.597)	(2.856)
Year fixed effects	Yes	Yes	Yes
Student environment	Yes	Yes	Yes
School environment	Yes	Yes	Yes
School fixed effects	Yes	Yes	Yes
Observations	29,895	142,909	128,159

Notes: Difference-in-differences estimates of β_3 (cf. Eq.1). Robust t-statistics in parentheses. Clustered standard errors are used to adjust for correlation of error terms within school. *** $p < 0.01$, ** $p < 0.05$, * $p < 0.1$.

Controlling for past municipality-level test scores Next, one may think that the decision of information disclosure by municipality may be correlated with past results of national assessments in the municipality. For example, the boards of education in municipalities with relatively low performance in the previous assessments may have a stronger incentive to improve the results, by disclosing the school-level results and making schools under their supervision more accountable for their own respective scores. Alternatively, they may implement other education policies in response to the low performance. To address this possibility, we estimate the same regression models (cf. Column 5 of Table 2) by additionally controlling for the average test scores at municipality level in the previous year. Column 2 of Table 3 reports results. Although some of the coefficients are smaller than those reported in Table 2, all remain positive and statistically significant.

Controlling for past school-level test scores Third, although our data do not have a panel structure, it is possible to estimate a quasi-value-added model by including school-level average test scores in the previous year as an additional control. Column 3 of Table 3 reports results. The difference-in-differences estimates are positive and significant except

for Mathematics A, suggesting that the benchmark results are still robust to the inclusion of the average scores at the school level in the previous year for Japanese A and B, and Mathematics B.

5.2 Parallel trend and lagged effects

One of the most important assumptions for the identification of the effect of information disclosure is that the treatment status is uncorrelated to unobserved factors correlated to test score. One way to check the validity of this identification assumption indirectly (at most) is to test a parallel trend assumption. For this purpose, we conduct an event study analysis to check whether treatment status is correlated to test score before 2014 when the information disclosure of test results at the school level was prohibited by the Ministry of Education. Specifically, we estimate the following regression equation:

$$\begin{aligned} Y_{ismt} = \beta_0 + \beta_1 T_m + \sum_{s=2007, s\neq 2013}^{2018} \beta_2^s \, year_t^s + \sum_{s=2007, s\neq 2013}^{2018} \beta_3^s \, (T_m * year_t^s) \\ + X_{ismt} \, \gamma_1 + Z_{smt} \, \gamma_2 + E_{mt} \, \delta + \epsilon_{ismt}, \end{aligned} \tag{2}$$

where $year_t^s$ is a dummy variable taking the value of one if $t = s$, otherwise zero. We take the year 2013, a year before the reform, as a reference year (hence setting $\beta_2^{2013} = 0$ and $\beta_3^{2013} = 0$). If the parallel trend assumption is satisfied, we expect that $\beta_3^s = 0$ for $s = 2007, ..., 2012$.

Table 4 summarizes the coefficients on the interaction term between year dummies and the treatment dummy. The estimates in the top panel reveal that the coefficients on the interaction terms are insignificant except for year 2007 for Japanese A and B and 2009 for Japanese A. In particular, none of coefficients for Mathematics is significant. These results validate our identifying assumption of the parallel trend to large extent.

Results from the event study are also useful to investigate how long it took for the effects of information disclosure to emerge. The bottom panel of Table 4 reports the estimates of

Table 4: Pre-reform trend and lagged effects (based on a model with school fixed effects)

	Japanese A	Japanese B	Mathematics A	Mathematics B
Treat*year_dum2007	-0.706*	-1.493***	-0.232	-0.176
	(-1.752)	(-3.620)	(-0.497)	(-0.445)
Treat*year_dum2008	-0.537	-0.421	0.277	0.067
	(-1.359)	(-1.192)	(0.661)	(0.170)
Treat*year_dum2009	0.785**	0.141	0.545	0.281
	(2.093)	(0.376)	(1.454)	(0.734)
Treat*year_dum2010	-0.211	-0.315	0.810	0.607
	(-0.196)	(-0.410)	(0.951)	(0.787)
Treat*year_dum2012	0.070	0.409	-0.203	0.768
	(0.170)	(0.795)	(-0.372)	(1.513)
Treat*year_dum2014	1.704***	1.137***	0.562	0.986***
	(5.580)	(3.429)	(1.478)	(3.086)
Treat*year_dum2015	1.312***	1.070***	0.923**	0.848*
	(3.309)	(2.942)	(2.256)	(1.905)
Treat*year_dum2016	0.997***	0.290	0.858**	0.715*
	(2.658)	(0.729)	(2.054)	(1.719)
Treat*year_dum2017	1.435***	1.056**	1.606***	1.281***
	(3.037)	(2.344)	(3.875)	(2.858)
Treat*year_dum2018	0.610	0.653	1.015**	1.265***
	(1.422)	(1.485)	(2.335)	(3.255)

Notes: Estimates of β_3^s (see Eq.2). Robust t-statistics in parentheses. Clustered standard errors are used to adjust for correlation of error terms within school. *** $p < 0.01$, ** $p < 0.05$, * $p < 0.1$.

the interaction terms for years from 2014 to 2018. Observe that for Japanese A and B, and Mathematics B, the coefficients on the interaction term between year 2014 and the treatment dummy are positive and statistically significant. These results suggest that the effects of information disclosure emerged in a short time period, i.e., only a few months after the Ministry of Education announced (in November 2013) that the reform on the information disclosure would be implemented from the national assessments in April 2014 onwards. Also, as suggested by the fact that the coefficients on the interaction between year 2017 and the treatment dummy are all positive and significant, the effects of disclosing school-level results on assessment scores persisted regardless of the subjects and contents.

5.3 Inspecting mechanism

5.3.1 School behavior

Acknowledging that the reform increased the average assessment scores in treatment cities after 2014, *how* did it change schools' behavior? To address this question, we investigate school's responses to survey questions accompanying national assessments. In particular, the school questionnaire contains the following question on *school accountability* to parents and the public:

> *To what extent did you explain your school's results on the national assessments in the previous year to parents and people in your district?*

Further, it contains question on school's use of national assessments as a *diagnostic tool*:

> *To what extent did you use analysis of your school's performance in the previous year's national assessments to improve the teaching quality of your school?*

To these questions, schools choose an answer from either 1) very well, 2) reasonably well, or 3) hardly.

Utilizing these questions (and answers), we investigate how the information disclosure of school-level results affects the above aspects of schools' behavior. Specifically, we estimate the following regression model:

$$\begin{aligned} Y_{smt} = \beta_0 + \beta_1 T_m + \beta_2 After_t + \beta_3 (T_m * After_t) + \overline{X_{ismt}}\,\gamma_1 + Z_{smt}\,\gamma_2 \\ + E_{mt}\,\delta + \epsilon_{smt}, \end{aligned} \tag{3}$$

where Y_{smt} is school's response to questions on school accountability and the use of national assessments as a diagnostic tool. $\overline{X_{ismt}}$ is school average of student environment variables. Other variables are as defined in the reference analysis above, i.e., Eq.1.

Table 5 presents the estimates of the effect of information disclosure on school accountability and school's use of assessment results as diagnostic tool. The structure of the table

Table 5: Reform and school behavior

Dependent var.	(1)	(2)	(3)	(4)	(5)
Accountability	0.283***	0.282***	0.290***	0.290***	0.253**
	(3.432)	(3.367)	(3.509)	(3.486)	(2.321)
Diagnostic tool	0.177***	0.171***	0.177***	0.175***	0.176**
	(3.146)	(3.028)	(3.135)	(3.093)	(2.408)
Year fixed effects	No	Yes	Yes	Yes	Yes
Student environment	No	No	Yes	Yes	Yes
School environment	No	No	No	Yes	Yes
School fixed effects	No	No	No	No	Yes
Observations	1,546 (1,748) for accountability (diagnostic tool)				

Notes: Estimates of β_3 (see Eq.3). Robust t-statistics in parentheses. Clustered standard errors are used to adjust for correlation of error terms within school. *** $p < 0.01$, ** $p < 0.05$, * $p < 0.1$.

follows Table 2, where different sets of controls are used. Observe that all the estimates are positive and statistically significant. This indicates that the public disclosure of school-level results of national assessments enhanced accountability of schools, and also made schools use assessment results better to improve their teaching quality. These changes in school behaviors can thus be seen as a mechanism through which average assessment scores increased in treatment cities.

However, one may also conjecture that the relative increase of test scores of students in schools of treated cities may be driven by the strategic behavior of schools, and thus does not necessarily reflect an improvement in student performance. One specific concern could be that schools influence who sits in assessments, since schools in treated cities may have an incentive to select students who they expect will perform well in assessments and discourage others from sitting in them. To address this concern, we apply Eq.3 and estimate the effect of the reform on the school-level *take-up rate* of assessments, calculated as the share of students who took assessments to the total number of (6th-grade) students in the school. Table 6 presents the estimates of the effect, confirming that the reform has an insignificant effect on the take-up rate of assessments in all the specifications. The indication is thus that schools did *not* go too far to make their performance *look* good.

Table 6: Reform and Take-up rate

Dependent var.	(1)	(2)	(3)	(4)	(5)
Take-up rate	0.001	0.001	0.001	0.001	0.001
	(0.350)	(0.244)	(0.233)	(0.372)	(0.326)
Year fixed effects	No	Yes	Yes	Yes	Yes
Student environment	No	No	Yes	Yes	Yes
School environment	No	No	No	Yes	Yes
School fixed effects	No	No	No	No	Yes
Observations			1,511		

Notes: Estimates of β_3 (see Eq.3). Robust t-statistics in parentheses. Clustered standard errors are used to adjust for correlation of error terms within school. *** $p < 0.01$, ** $p < 0.05$, * $p < 0.1$.

5.3.2 Student behavior

Having studied schools' responses to the reform, we now turn to how students' behaviors are affected. To proceed, we investigate students' responses to various questions which accompany national assessments. While all the three subsequent questions are about Japanese for illustration, equivalent questions were asked about Mathematics too.

First, we analyze how students may change their *approach* to assessments, by examining their responses to the following question:

> *This year's Japanese test contained a type of questions which required you to formulate an answer in writing. To what extent did you attempt to answer them?*

To this question, students choose their responses from 1) I attempted to answer all the questions of this type as fully as possible, 2) I often gave up answering this type of questions fully, and 3) I did not even begin to answer them. Next, on whether students *understand* subjects, we focus on the following question:

> *Do you understand contents taught in Japanese classes?*

Students' possible answers to this are 1) Yes, 2) Yes, if I have to choose, 3) No, if I have to choose, 4) No. Further, regarding whether students *like* subjects, we study responses to the question:

> *Do you like studying Japanese?*

Table 7: Reform and student behaviors (1)

Dependent var.	(1)	(2)	(3)	(4)	(5)
Attempt_Jpn	0.029**	0.031**	0.032**	0.034***	0.031**
	(2.161)	(2.353)	(2.456)	(2.599)	(2.032)
Attempt_Math	0.064***	0.072***	0.073***	0.079***	0.065**
	(2.698)	(2.928)	(3.001)	(3.308)	(2.419)
Understand_Jpn	0.057***	0.058***	0.059***	0.060***	0.049***
	(3.289)	(3.300)	(3.746)	(3.728)	(2.899)
Understand_Math	-0.006	-0.005	-0.003	-0.001	0.011
	(-0.279)	(-0.227)	(-0.132)	(-0.034)	(0.460)
Like_Jpn	0.099***	0.098***	0.100***	0.101***	0.082***
	(3.794)	(3.718)	(4.029)	(4.053)	(3.400)
Like_Math	-0.025	-0.023	-0.019	-0.017	-0.029
	(-0.959)	(-0.894)	(-0.774)	(-0.669)	(-1.137)
Year fixed effects	No	Yes	Yes	Yes	Yes
Student environment	No	No	Yes	Yes	Yes
School environment	No	No	No	Yes	Yes
School fixed effects	No	No	No	No	Yes
Observations	up to 164,912				

Notes: Estimates of β_3 (see Eq.4). Robust t-statistics in parentheses. Clustered standard errors are used to adjust for correlation of error terms within school. *** $p < 0.01$, ** $p < 0.05$, * $p < 0.1$.

Their possible answers are the same as the ones above.

Similar to the analysis on the reform and test scores (Eq.1), we estimate the following regression model:

$$Y_{ismt} = \beta_0 + \beta_1 T_m + \beta_2 After_t + \beta_3 (T_m * After_t) + X_{ismt}\,\gamma_1 + Z_{smt}\,\gamma_2 + E_{mt}\,\delta + \epsilon_{ismt}, \tag{4}$$

where Y_{ismt} is student's response to questions on the approach to tests, understanding subjects, and liking subjects. The remaining variables are defined as in Eq.1. Table 7 summarizes the effects of the reform on student's behaviors, i.e., the coefficient on β_3 in Eq.4. On the approach to tests, it is revealed that students attempted harder to answer questions which required them to elaborate an answer, both in Japanese and Mathematics. On students' understanding of subjects, students felt that they understood contents taught in Japanese classes after the reform. Finally, students liked Japanese more after the reform than before.

Table 8: Reform and student behavior (2)

Dependent var.	(1)	(2)	(3)	(4)	(5)
Talk_to_parents	0.024	0.043**	0.046***	0.049***	0.047***
	(1.377)	(2.516)	(3.090)	(3.237)	(2.669)
Year fixed effects	No	Yes	Yes	Yes	Yes
Student environment	No	No	Yes	Yes	Yes
School environment	No	No	No	Yes	Yes
School fixed effects	No	No	No	No	Yes
Observations			133,406		

Notes: Estimates of β_3 (see Eq.4). Robust t-statistics in parentheses. Clustered standard errors are used to adjust for correlation of error terms within school. *** $p < 0.01$, ** $p < 0.05$, * $p < 0.1$.

We also consider the possibility that the reform affects student outcomes *through* parents. This is possible to the extent that parents are affected by schools which appear to be more accountable to them. To investigate this potential channel, we look at students' response to the question on communicating with parents at home on school matters. In particular, we use students' response to the following question:

Do you talk to your parents about what happens in school?

To this question, students' responses are either 1) Yes, frequently, 2) Yes, rather frequently, 3) Yes, but not frequently, 4) Not at all. Table 8 shows results on the effect of the reform on this aspect of student's behavior. In all the specifications except for Column 1 without controls, the effect is positive and statistically significant, indicating that the reform prompted students to talk to parents about what happens in school more frequently. This result is consistent with the possibility that the effect of the reform on student outcomes is materialized partly through parents being affected by the reform.

5.4 Are there trade-offs?

The results reported so far indicate that the information disclosure of school-level results of national assessment has a positive impact in that students' test scores increase *on average*. One may, however, be concerned with possible "side effects" or "unintended effects",

given that the reform induced more focus on schools' average test scores. In this section, we investigate two potential side effects, namely on the within-school variations of scores and non-cognitive skills of students.

5.4.1 Impacts on within-school variations

Whereas the above evidence suggests that the reform increased school average test scores, what about the within-school variance of scores? This is a reasonable concern, since if schools have an incentive to improve average test scores, they may put an effort on improving test results of a certain sub-group of students whose scores are seemingly *easier* to improve. If this is the case, the positive effect of the reform may potentially be biased towards the improvement of highly performing students so that the variance of test outcomes within a school increases. This would be an adverse effect, since poorly performing students may be left behind, promoting inequity among students.

To investigate this possibility, we estimate the effect of the reform on the within-school variance of test scores. Table 9 summarizes results for each subject as well as content. The estimated model is similar to Eq.3, with school fixed-effects controlled for (as in Column 5 of Table 5). Notice that all the estimates are negative, and statistically significant for basic contents in particular (i.e., Japanese A and mathematics A). The implication is thus that it is poorly-performing students' scores which increase relatively more after the reform. Overall, these results suggest that disclosing school-level results of national assessments did not increase the disparity of test results among students within a school; it rather tended to improve equity by reducing the disparity.[17]

[17]We estimate the effects of the reform on test scores using a quantile regression model similar to the model of Eq.1, and find that the positive effects of the reform are observed strongly for students with low and medium level of scores.

Table 9: Within-school variance by subjects and contents

Subjects	Japanese A	Japanese B	Mathematics A	Mathematics B
	(1)	(2)	(3)	(4)
Treatment*After-reform	-0.539***	-0.186	-0.355*	-0.172
	(-3.063)	(-1.205)	(-1.748)	(-1.428)
Year fixed effects	Yes	Yes	Yes	Yes
Student environment	Yes	Yes	Yes	Yes
School environment	Yes	Yes	Yes	Yes
School fixed effects	Yes	Yes	Yes	Yes
Observations			2,307	

Notes: Estimates of β_3 (cf. Eq.3). Robust t-statistics in parentheses. Clustered standard errors are used to adjust for correlation of error terms within school. *** $p < 0.01$, ** $p < 0.05$, * $p < 0.1$.

5.4.2 Impacts on non-cognitive skills

Are there any adverse effects on non-test score outcomes of students induced by the reform? One may think that schools with excessive focus on subject teaching would sacrifice the nurture of non-cognitive traits of students on self-confidence and relationship with friends and society. Here, we investigate how the reform affected (so-called) non-cognitive skills, outcomes beyond test scores. For example, the aforementioned student questionnaire contains a question related to students' self-confidence:

Do you think you have virtues?

Also, it contains various questions on consideration for others, social interest, and friendship:

Do you think that bullying is unacceptable under any circumstances?

Are you interested in what happens in your district and society?

Do you enjoy meeting your friends at school?

Possible responses to these questions are 1) Yes, 2) Yes, if I have to choose, 3) No, if I have to choose, and 4) No. Using the model of Eq.4, we estimate the effects of the reform on these measures.

Table 10: Reform and student's non-cognitive skills

Dependent var.	(1)	(2)	(3)	(4)	(5)
Self_confidence	0.032	0.034	0.034	0.034*	0.049**
	(1.428)	(1.479)	(1.597)	(1.652)	(2.145)
No_bully	0.001	0.005	0.004	0.006	0.011
	(0.096)	(0.425)	(0.449)	(0.566)	(0.950)
Social_interest	0.068***	0.058***	0.059***	0.059***	0.035*
	(3.179)	(2.893)	(3.216)	(3.185)	(1.847)
Fun_friends	-0.001	-0.002	-0.003	-0.002	-0.018
	(-0.114)	(-0.132)	(-0.253)	(-0.188)	(-1.520)
Year fixed effects	No	Yes	Yes	Yes	Yes
Student environment	No	No	Yes	Yes	Yes
School environment	No	No	No	Yes	Yes
School fixed effects	No	No	No	No	Yes
Observations			up to 164,845		

Notes: Estimates of β_3 (see Eq.4). Robust t-statistics in parentheses. Clustered standard errors are used to adjust for correlation of error terms within school. *** $p < 0.01$, ** $p < 0.05$, * $p < 0.1$.

Table 10 summarizes the estimates of the effects of the reform on non-cognitive measures. Results show that the reform tends to have a positive effect on students' self-confidence, particularly when school fixed effects are included (Column 5). Indeed, this may have something to do with the reform increasing test scores. Although the reform hardly affects the perception of bullying and the happiness of meeting friends, it is significantly associated with a larger interest in social issues. Admittedly, these results are hard to interpret. However, what is important to observe is that there seems to be little indication that the reform had adverse effects on the measures related to non-cognitive skills of students.

6 Concluding remarks

In this paper, we studied empirically the effects of information disclosure of national assessment results at the school level on various outcomes of students, covering both test scores and non-cognitive traits. To uncover the potential mechanisms through which the reform affects students educational outcomes, we also investigated the effects of the reform on schools' and students' behaviors. Results revealed that publishing school-level results of national assess-

ments increases test scores on average, regardless of the subjects and contents. This occurs (at least) partly because schools become more accountable to the public, and utilize diagnostic information from assessments better to improve teaching quality. We also found that students, in turn, attempt to answer assessment questions harder, understand subjects better, like subjects more, and communicate more with parents on school matters. There was little evidence for adverse effects on student outcomes, in that the within-school variance of test scores tends to fall, and there is no adverse impact on students' non-cognitive skills.

On balance, therefore, results indicate that publishing school-level results may be a good design feature of national assessments. Although we do need more empirical evidence from different institutional/cultural settings to generalize this indication, we hope that we offered one comprehensive evidence to shed light on the ongoing debate on how national assessments should be designed.

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