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ABSTRACT

School Closures and Student Achievement: Evidence from a High Stakes Exam*

We study the effect of school closures and the transition from on-site to on-line teaching during the Covid-19 pandemic in the Finnish upper secondary schools. To identify the effects we exploit variation in the length of school closure periods across schools between autumn 2020 and spring 2021. Using a difference-in-difference design, we show that the students who studied on-line for longer periods performed equally well in the Matriculation exam at the end of upper-secondary education than the students who experienced shorter school closures. Moreover, we show that inequalities across Finnish students from different socioeconomic backgrounds did not exacerbate during this period.

JEL Classification: I21, I24, I28
Keywords: school closures, online teaching, test scores, COVID-19

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1 Introduction

Suspension of on-site teaching and adoption of various online teaching methods was one of the primary policy tools used to contain the spread of Covid-19 infections. Although the infections were often less severe for young children, contacts between children were restricted to reduce the risk of infection among parents of school-age children. However, already in Spring 2020 when school closures started, these policies raised several concerns as the effectiveness of online methods in comparison to standard classroom teaching was not clear[1]. Moreover, as parents vary in their capabilities to support studying at home, school closures could potentially increase inequality across students from different socioeconomic backgrounds (Aucejo et al., 2020; Engzell et al., 2021; Rodríguez-Planas, 2022) or the evolution of the gender gaps in education (Bratti and Lippo, 2022).

Measuring the effect of school closures on learning outcomes is in many ways a difficult task. The effects of the suspension of on-site teaching, implemented to prevent the spread of the Covid-19 infections, are difficult to distinguish from other adverse effects of the pandemic. Even measurement of outcomes is difficult as organizing on-site test events also involved risks and students therefore took achievement tests less often and sometimes under different conditions.

In this paper we evaluate the effects of school closures and the switch to remote teaching on student outcomes in the Finnish upper secondary schools. We focus on student performance in the Matriculation exam, a final exam that all Finnish upper secondary school students at the general track take at the end of secondary school. This exam is a high stakes test that universities and colleges use as their main admission criteria. The

[1] Before spring 2020, the only existing papers evaluating the effectiveness of online learning in comparison to face-to-face classroom instruction focused on college students. The existence of this research was closely related to the expansion of the open universities, the growing offer of e-learning platforms and the expansion of the MOOCs experienced on the recent years. In general, this papers find that while pure on-line teaching in comparison to on-site teaching lowers educational achievement, the learning outcomes from students in hybrid mode are not different from those in traditional on-site mode (Figlio et al., 2013; Bowen et al., 2014; Joyce et al., 2015; Alpert et al., 2016; Cacault et al., 2021)

exam takes place in the same format and at the same time in all Finnish upper secondary schools and was also arranged during the Covid-19 pandemic. The test is externally graded and the outcomes therefore strictly comparable across schools. We show that the length of the school closure period had no relevant effect on the likelihood of participating in the Matriculation exam nor on the exam results.

The experiences of Finnish upper secondary school students provide an opportunity to identify the effect of school closings in a reliable way for several reasons. First, Covid-19 restrictions between autumn 2020 and spring 2021 were set locally and there was wide variation in the length of remote teaching periods across different upper secondary schools. Hence it is possible to compare students in schools with longer interruptions of live teaching to students in schools with shorter breaks. In general, the restrictions were tighter in large cities in the Southern Finland and more lenient in the countryside and in the northern parts of the country but there is substantial variation also within regions. Second, the Covid-19 situation was relatively favorable in Finland until spring 2022. The number of infections was among the lowest in Europe during 2020 and 2021. Hence, direct effects of infections on student outcomes are less likely to contaminate estimates of school closure effects. Even the Matriculation exam was arranged on-site in its standard format also during the Covid-19 pandemic. Third, richness of Finnish data allows controlling for previous outcomes both at the school-level and at the student-level and identifying the effects from changes in test scores across schools using a simple differences-in-differences approach. Data also allows studying the effects of school closures separately for different students and identifying groups that were most affected by school closures. Finally, there is survey information available on the measures that schools adopted in organizing remote teaching.

Our empirical strategy exploits variation in the intensity of the restrictions faced by students from different municipalities to identify the effects of school closures. This approach allows us to disentangle the effects of suspending live teaching on students' achievement from other adverse effects from the pandemic. This is a key issue that cannot be unraveled using an across cohort comparison, an empirical strategy followed by many other papers studying this topic (Engzell et al., 2021; Lichand et al., 2022; Contini et al., 2021; Abufhele et al., 2022).

We present three main results. First, we show that the length of the restrictions, and thus the time spent in on-line teaching, did not affect the composition of students who were taking the matriculation exam. We only find a small negative but statistical significant effect on the likelihood of participating in the matriculation exam for students from the 2017 and 2018 entry cohorts, which were affected by the pandemic at some stage of their education compared to the students from the 2016 entry cohort. Second, we show that, on average, those students tutored for longer periods of time though online means did not perform worse in the matriculation exam than those who remained most or all the time on-site. Third, we provide evidence that switching to remote learning did not exacerbate inequalities across students.

Our study contributes mainly to the literature that tries to quantify the effects of the policies implemented during the Covid-19 pandemic, and in particular school closures, on educational outcomes of students. The first papers that used empirical observations on outcomes during the pandemic include Maldonado and De Witte (2020) who examined the effect on test scores in Belgium and Contini et al. (2021) who study the effects of the pandemic in math skills for primary school pupils in Italy. After that, the number of studies on the effects of the pandemic on learning outcomes quickly increased.

In order harmonize the results from this growing number of studies, Betthäuser et al. (2022) and Betthäuser et al. (2023) synthesize the existing research in two meta studies. The first one, Betthäuser et al. (2022), reviews a total of 34 studies from 12 countries. However, according to the authors, 48% of these studies had a serious risk of bias and only 8% i.e three studies have low risk of bias. These three are Engzell et al. (2021) who evaluated the effects on test results in the Netherlands for students between ages 8 and 11, Birkelund and Karlson (2021) who analyse the evolution of Danish students' scores in standardized tests in math and reading and Lichand et al. (2022) who focus on students from Sao Paulo. The second one, Betthäuser et al. (2023), includes a total of 42 studies from 15 counties. In this second one, the number of studies with low risk of bias increased up to 15%. In general both meta studies conclude that the pandemic slowed the learning progress of students. In particular, Betthäuser et al. (2023) concludes that the average effect across studies mean learning deficits derived from the pandemic are equivalent to students loosing a 35% of a school year's worth of learning.

So far, most studies have focused on cross-cohorts comparisons and time-series variation in student outcomes to estimate the effects of school closures on test-scores. Even the studies that use difference-in-difference setting typically compare changes in test scores during the school closure period to the changes in otherwise comparable periods in past. In fact, according to Betthäuser et al. (2023), the most common source of potential bias that studies in this topic suffer stems from comparing only two time points without taking into account time trends in learning progress and selection bias from either schools or students. In addition, the time series approach cannot distinguish the effect of school closures from other adverse effects of the pandemic.

Our study differs from previous attempts as we use cross-sectional variation in school closings together with panel data with repeated observations on both the schools and students. This helps us in disentangling the effects of school closings from other adverse effects that the pandemic may have had. Our results for the Finnish context contrast with those found in Belgium (Maldonado and De Witte, 2020), Italy (Contini et al., 2021; De Paola et al., 2022), the Netherlands (Engzell et al., 2021) or Chile (Abufhele et al., 2022). In general, this studies find that the closure of schools harmed students academic performance and progression[2]. Instead, our results are similar to the ones found

[2] Specifically, Maldonado and De Witte (2020) find that in Belgium scores decreased by 0.17 SD in mathematics and 0.19 SD in Dutch for the cohorts affected by the restrictions compared to previous

in Denmark (Birkelund and Karlson, 2021), where no major learning losses nor major differences across family background are found.

We also add to the literature on the effects of technology on education. This literature has mainly focused on how remote lessons can be a complement to traditional school, specially for college students given the rise of Massive Online Courses (MOOCs) (Banerjee and Duflo, 2014; Bettinger et al., 2017) but also how this affects access to formal education both to college and secondary education (Goodman et al., 2019; Navarro-Sola et al., 2021). In this paper we provide evidence that upper secondary school students in Finland who attended school on-line or in hybrid mode for longer periods performed no worse than their peers who were educated on-site.

The rest of the paper is organized as follows. Section 2 describes the education institutions in Finland and the restrictions implemented in the schools in order to curtail the spread of the Covid-19 virus. In section 3 we present the dataset, as well as, relevant summary statistics. Section 4 explains the empirical strategy used. Section 5 presents the main results of the paper. Finally, in section 6 we discuss the results and conclude.

2 Education Institutions in Finland

In Finland, all children attend compulsory comprehensive school for nine years. School starting age is seven and class retention is rare so almost all students finish comprehensive school in the spring of the year when they turn 16. Compulsory school age has been extended to 18 in 2021, but the cohorts that we study could have quit school already

ones. Contini et al. (2021) finds that the pandemic had a negative impact on pupils' performance in mathematics (-0.19SD) and that it was grater for the best performing students (-0.51 SD) and girls (-0.29 SD) from low educated parents. De Paola et al. (2022) find that the shift from face-to-face to online teaching in the Italian tertiary education reduced students' performance of about 1.4 credits per semester. Engzell et al. (2021) find that test scores gains were substantially lower during school closures (-0.08 SD, which is equivalent to one-fifth of a school year) and were 60% larger among students from less-educated homes. Abufhele et al. (2022) focus on pre-primary pupils in Chile and find that the pandemic had an adverse impact in language development of 0.25 SD.

after nine years in comprehensive school at age 16. Very few do so, about 95% of the students apply to upper secondary schools. Secondary schools use GPA at the end of comprehensive school to select their students.[3]

The upper secondary school is divided in two tracks, vocational and general. We focus on the general upper secondary school students (lukio) because they take the same exam at the end of secondary school in all schools. In the cohorts used in this study, 53% of students enter this general track. On average, the general school students have higher grades at the end of comprehensive school than vocational school students so our data is not fully representative of the entire cohort of students (see Table A.I).

General upper secondary school is designed to be a three-year program[4]. As a graduation requirement all students take a Matriculation examination at the end of upper secondary school. For graduation one has to pass the exam in four subjects (five from 2022 onward). The only compulsory exam is mother tongue which is Finnish for over 90 percent of students and Swedish for the Swedish-speaking minority. In order to graduate the student then has to complete three other exams chosen from mathematics; second national language; foreign language; or humanities and natural sciences. In addition, the students can take one or more additional tests.

The Matriculation Examinations are held biannually, in spring and in autumn. The test is taken on-site at schools under strict monitoring to avoid any chances of cheating in the test. The test procedures have been unchanged over the years covered in our data, also during years affected by Covid-19 infections. The candidates must complete

[3] Grades in comprehensive schools range from 4 to 10. In the least selective upper secondary schools the minimum entry requirement is around 7 while in most selective schools minimum requirement is over 9.5. There is some year-to-year variation in these entry criteria but in general the selectivity is relatively stable across schools. The comprehensive school grades are available from the centralized admission system and therefore allow controlling for the student quality at the time of entry into upper secondary school. However comprehensive school grades are given by students' own teachers and are therefore not strictly comparable across schools.

[4] Most students also complete upper secondary school in three years, but it is possible to squeeze the required 75 courses to two and a half years or, more commonly, study at a lower pace and complete the upper secondary school in three and a half or four years.

the examination during no more than three consecutive examination periods. Each exam takes place on separate day and students have six hours to complete the exam[5]. In table A.II in the Appendix we show how the three cohorts studied are distributed across the different exam periods. For all cohorts, we observe that students mostly take their exams in autumn and spring of their third year.

The math test and the language tests are arranged at two different levels of difficulty; the advanced syllabus and the basic syllabus. As already noted, universities select most of their new students based on matriculation examination results. Universities decide individually their entry requirements but always give more points for the advanced level tests.

Grading in the matriculation exam follows a seven-point scale from improbatur (=failed) to laudatur (=excellent). Grades are normalized so that the distribution of grades is similar each year so that students from different cohorts have comparable grades when applying to universities. The grading system also accounts for selectivity and are adjusted so that a larger fraction receives excellent grades in subjects that are taken by, on average, better students (eg. advanced math).

2.1 Covid-19 restrictions in Finnish schools

In spring 2020 when the first cases of Covid-19 infections were detected in Finland the government declared a state of emergency. As part of the measures to limit the spread of the virus, all Finnish schools were closed from March 18th until May 14th, i.e. for almost two months[6]. This took place in the middle of spring examination period. To ensure that final exams in all subjects could be arranged some exams moved to an earlier

[5] Since 2019 all exams are in digital format, typically performed using students' personal laptops. At the start of a test, candidates boot into a Linux operating system from a USB memory that is delivered to schools by the Matriculation Examination Board. Due to the tailored operating system, candidates cannot access their local files and programs and can use only applications and materials that are pre-installed on the operating system.

[6] Some secondary schools continued remote teaching until the end of spring term. However, the summer holidays start in Finland already in the beginning of June so there were no major differences in the length of school closing episodes in the spring term of 2020.

date. This reduced preparation time and could have affected the exam results. However, these effects would be hard to detect as school closures affected all students, so there is no clear comparison group.

Figure I displays daily number of infections In Finland. In 2020 and in 2021 these numbers were still reasonably low. The school closings were mainly a preventive measure at the time when vaccine coverage was still low. In Figure I we also plot the timeline of school closing policies in Finnish secondary schools by displaying the fraction of students who were not attending school in a given day. As shown in the figure, the peak in school closing intensity was in December 2020 when the second wave of the epidemic hit Finland. Yet even at the peak 40% of the secondary school students were still at school. From 2021 onward, the Finnish schools remained open despite of a sharp rise in infection rates in 2022.

School closings had no effects on teaching of students preparing for exams in spring 2020 as they had no classes left at the time of first school closing period. In contrast, the school closing could have affected the exam results in fall of 2020 and in particular in the spring 2021 as final classes and on-site preparation for the exams were interrupted by school closings. School closings could also have effects in 2022 but test data for 2022 linked to other sources is not yet available.

There was substantial variation in school closing policies in the fall of 2020 and in the spring of 2021. Decisions on school closings were made at the local level, typically by school board of a city following recommendations by Regional State Administrative Agencies (AVI).

In fall 2020 the Covid-19 cases were more common in large cities in the Southern Finland and hence school closing policies were also adopted to a larger extent in these regions. In Figure II we display the restrictions on a map that, in addition to demonstrating that school closures were longer in the southern Finland, also indicates that there is some clustering of restrictions in nearby municipalities.

However, a school closing does not imply that teaching would end. Rather the Finnish schools rapidly moved to on-line teaching. Methods of implementing varied from moving the classroom to Teams or Zoom - the two most commonly used online platforms in the Finnish schools - to sending the students exercises and asking the students to complete them independently with the help of a textbook.

The schools were prepared for online teaching in varying degrees. In a survey to school principals that was implemented as a part of EduRescue-project at University of Jyväskylä slightly over half of the principals responed that teachers in their schools had received training both in technological a pedagogical skills required in on-line teaching. Typically this training was rather brief, 1-2 hours. About a third of the teachers had had at least one day of training in remote teaching methods. 71% of the principals report that during school closures lectures were mainly live on-line teaching and all respondents claim that teachers in their schools had daily contact with their students.

3 Data

Our main sources of data consist of (1) exam results from the Matriculation Exam Board, (2) application data from the secondary school joint application system and (3) basic demographic information on population of students and their parents from Statistics Finland. To these register files, we link (4) separately-collected data on Covid-19 restrictions and survey results from the Principal Barometer.

Matriculation Examination Board publishes after each exam period all exam results on its home page. The results are listed by student and by subject, hence providing a complete picture of the exam scores. Individual ID's are concealed in the public version but school names are in cleartext allowing comparisons at the school level with publicly available data.[7]

To allow separate analyses by subgroups of students and to allow controlling for possible changes of student composition, we applied for access to confidential student-level data in a format that can be linked to other data files using person id's. We use these data at Statistics Finland servers in an anonymized format. Data are also available for any other researchers but access to data requires a user licence from Statistics Finland.[8]

Joint Application System Register data contains all applicants into all secondary schools in Finland. Data are collected from the centralized admission system are contain applications and admission results, as well as, all grades from the comprehensive school because secondary schools use these grades as their main admission criteria. We use these entry grades as controls to ensure that student composition has not changed in ways that would be correlated with school closings. Controlling for the entry grades also increases the precision of the estimates as entry grades are highly predictive for Matriculation examination outcomes. We also use the Joint Application Register data (i.e. data from the time of entry into secondary school) as an alternative way of creating the sample and the treatment and control groups to ensure that possible effects of school closing on the propensity of participating in the exams will not cause a bias in the results.

The basic demographic data are based on various registers collected and distributed by Statistics Finland. These registers cover the entire population of Finland. The files allow us to create a link between the students and their parents and to find information on occupation, taxable income and highest completed education of the parents. Same register

[7] Matriculation exam board data excludes a small fraction of Finnish students that take International baccalaurete (IB) or Deutsches Internationales Abitur (DIA) offered by some Finnish secondary schools

[8] Instructions for application for a license to use statistical data can be found at https://www.stat.fi/tup/mikroaineistot/hakumenettely_en.html

files also provide information on nationality, place of residence and mother tongue of the students. In practice, we focus on Finnish speakers omitting a small Swedish-speaking minority and immigrants studying Finnish as their second language.

Collecting register-based data on the full population of students and their parents is easy in Finland. Collecting data on the school closings was much more challenging. The decisions to close schools were made at the local level and no national institution had collected data on these decisions. We started from data collected by professor Mika Kortelainen and his research group for a report on the effect of distance learning on spread of Covid-19 infections. These data were complemented by a survey to all members of Finnish Principal Association, by reviewing the minutes of meetings from local school boards, by reading local newspapers that archive their articles on their websites and by contacting school secretaries directly by email. As a result of these effort, we have a reliable measure on the number of days of school missed during the school year for 93% of Finnish high school students.

According to our data most school closings took place in all secondary schools of the same municipality on the same dates. Most notable exception involves private schools that made their decisions independently. Even in these cases the differences in school closing dates were very small, typically within 2 - 3 days. Also neighboring municipalities usually closed schools roughly at the same time which is natural if they followed recommendations from the regional health authorities.

Finally we used data from the Principal barometer, an on-going annual survey of the principals. During the pandemic the survey has concentrated in collecting data on working conditions of principals and the teachers. We had an opportunity to add five extra questions to this survey with the intention to measure the methods that the schools have utilized in moving to online teaching as well as the technical and pedagogical preparedness of the teachers to teach online.

In Table I we report summary statistics for the key background variables used in analysis by entry cohort. There are about 30,000 applicants to the general secondary schools in each cohort. About 60% of the general secondary students are women, almost all are Finnish citizens and the vast majority are native Finnish speakers. These students come from families with above average education level: 63% of mothers have taken matriculation exam themselves and about 45% of mothers have some higher education. This comparison also shows that the 2018 entry cohort that was most affected by the school closings is very similar to the two previous cohorts.

Figure III plots the distribution of the key outcome variables, scores in Finnish exam that is compulsory for all students and scores in the math exams that have the highest weight in university admissions. As noted before matriculation exams are graded with letter grades on a seven point scale. For calculating averages, these scores are usually simply converted to numbers ranging from 0 to 7. To adjust for the difficulty of the exam, the grades are normalized to have the a similar distribution every year.

In Figure IV we plot the average grade in the exam against quantiles of the entry grades i.e average grades in 9th grade of the comprehensive school. We do this separately by entry cohort for cohorts starting in upper secondary school in 2016, 2017 and 2018.

As the grades are normalized separately each year, there cannot be a shift in average grades across years. However, Figure IV also shows that the relationship between the entry grades and matriculation exam scores is stable across cohorts. No sign of differential changes across the distribution of entry grades can be seen from these data. The graph also shows that, as expected, entry grades are highly predictive for matriculation exam scores and clearly an important variable to control for. The key issue explored the empirical section is whether there are any differences in exam results, after conditioning on entry grades, among students in schools that were closed for longer periods compared to students in schools that remained open over most of the pandemic period.

Table II shows how student composition changes in the matriculation examinations. The 2018 cohort, that is affected by the pandemic, is slightly less likely to participate in the matriculation exam though the difference to earlier cohorts is less than one percentage point. The 2018 cohort also takes both less compulsory exams and voluntary exams which indicates both delays in graduation (one cannot graduate before completing four exams) and narrower selection of exams. Differences across students in schools with long school closures and in schools with shorter closures are small. Most importantly the differences across cohorts appear to be similar in schools with long closures than in schools with shorter closures. Hence proportion of students taking the exams and selectivity of students in exam is probably not affected by school closures which makes analysing effects on exam results more straightforward.

4 Empirical Strategy

To evaluate the effect of school closings on the performance of students in the entrance to university exams we estimate the following two-way fixed-effects specification

$$y_{ist} = \alpha + \beta\, School\, closed_{ist} + \gamma_s + \delta_t + \theta\, X_{ist} + \varepsilon_{ist} \tag{1}$$

where y_{ist} is the outcome of interest, i.e. in most cases a score in a specific exam, for student i who attends school s and participates in exam in period t. $School\, closed_{ist}$ measures the number of weeks that the upper secondary school that the student attended was closed[9].

In an alternative specification we focus on performance of different entry cohorts (irrespective of when they take the exam) rather than performance of the students participating in the exam in different exam periods (irrespective of which entry cohort they

9 Note that for most of the students who start upper-secondary in 2016 and 2017 this variable will be 0 as they had already finished school on the 2020-2021 school term

belong to). The benefit of comparing cohorts is that it is also possible to measure the effect of restrictions on the likelihood of taking the exam and, if needed, make adjustments for sample selectivity. Comparing exams taken at a given date is perhaps a more straightforward measure for the effect of school closures before the exam. Empirically the results turn out to be very similar.

Including the school fixed effects γ_s purge any systematic variation across schools. In addition, X_{ist} is a set of individual level control variables to account for students' socioeconomic and demographic characteristics. The most important ones are the grade point average from the comprehensive school that is highly predictive of matriculation exam score and the mother's education defined as the highest degree completed by the student's mother by at the time when the student enters secondary school.[10]

For evaluating the effect of school closures on exam scores the coefficient of interest is β that measures whether the effect of number of weeks of school closures on the Matriculation exam scores. Any permanent differences across schools, as well as, differences across time are captured in the regression by the cohort and school dummies. Additionally, key observed differences across individuals, such as students' entry to upper secondary school grades, are also controlled. Key identifying assumption is that, conditional on student characteristics, if school had remained open during 2020 and 2021, the exam scores in the schools that eventually were closed for long periods would have evolved in the same way than scores in schools that were closed for shorter periods or not closed at all. The assumption cannot be tested, but we provide evidence that this common trends assumption holds in the pre-pandemic years (see Figure V and FigureVI).

To increase efficiency, in the Appendix we also present estimates from a difference-in-difference approach where we omit school dummies and instead include number of weeks of school closures interacted with cohort dummies. In this specification weeks of school

[10] The full set of controls is defined by the following variables:student's entry to upper secondary GPA, students' gender, if the student has the Finnish nationality, whether if the mother has the Finnish nationality, if the mother took the matriculation exam, if the mother has attended university, if the mother is employed, if the father is employed and the number of children in the family.

closures capture all relevant cross-section variation between schools and effects of school closures in the pandemic years are identified by the interaction of school closures and cohort that was affected by these closures. In practice, this interaction is equivalent to the β from equation 1.

5 Results

This section presents the main results of the paper. It begins by discussing the effects of school restrictions on the matriculation exams obtained from the main specification. We focus on the Finnish exam because it is the only compulsory exam and the math exam because it is the one that universities give most weight when selecting students. Then, it discusses how this results contrast with an across cohort comparison. Finally, this section concludes by studying the heterogeneous effects that school closures across students with different observable characteristics.

5.1 School closures and Student's Test Scores

The results from our main specification are collected in Tables III and IV. The differences between these two tables is that in Table III we control the year-term when the students participate in the exam and in Table IV we control for the year in which each student enters into upper secondary education. Both tables reflect the effect of the number of weeks schools remained closed on the students' test scores in the Finnish, advance math and basic math tests. Columns (1), (3), (5) display the coefficients from a specification that does not include the individual level controls while columns (2), (4) and (6) show the coefficients from a specifications that adds those controls.

Results from this table could potentially be different if the composition of students taking the matriculation exams were different. Say if for example the cohort of students who started upper-secondary school in 2018, which was affected by the restrictions, were less likely to participate in the matriculation exams or changed their timing regarding the year-period in which they participated in each exam. As mentioned in section 3, Table A this is not the case, and selection of students across entry cohorts does not seem to be a problem in our setting.

Our results show that school restrictions had no significant effect on the students' performance in any of the tests and regardless of the specification we look at and the way we define cohorts. Point estimates are very small and statistically indistinguishable from zero, for example for the Finnish mother tongue exam an additional week with school restrictions would be translated into a decrease of 0.002 points. If we take the average score from the 2018 cohort, this would mean moving from a score of 4.102 to 4.100, which in practice means a change equal to 0.

Additionally, In Panel B from Table III instead of pooling all the restrictions together, we differentiate between the restrictions that were implemented during the autumn term and the spring term. Again, results from this exercise show that the number of weeks that school remain closed did not represent an extra burden between students who ere in municipalities with more and less restrictions.

Overall, our results indicate that, on average, those students who where in schools that were closed for longer periods between Autumn 2020 and Spring 2021 did not perform neither worse or better than those students who remain on site for most of the time. This result contrasts with previous findings from papers that study the effect of Covid-19 preventing policies on student outcomes (Engzell et al., 2021; Lichand et al., 2022; Contini et al., 2021; Abufhele et al., 2022) but go in line with those find in Denmark by (Birkelund and Karlson, 2021). These differences can have different potential explanations. First, it could be that Finland adapted to remote learning better than other countries. In section 6 we further discuss this explanation. Second, it also may be that most of previous studies lack of geographical variation in the restrictions applied and hence rely on across cohort comparisons. Instead, our empirical strategy is able to disentangle the effects of school closing from other pandemic-related shocks that affected the whole cohort. In Table V we show how our results would change if we had relied on an across cohort comparison. We find a negative effects for 2018 and 2017[11] cohort scores in the Finnish mother tongue test (-0.136 points and -0.031 respectively) and the basic math test (-0.084 points and -0.077)[12], while no significant effects for the advance math test once we control for socioeconomic background and student entry to upper-secondary scores. Despite being statistically significant these results are still small. Nevertheless, this exercise shows that it can be the case that comparing cohorts who had to face school restrictions to those who did not may mask the effects of other pandemic related shocks with the effects of online teaching.

5.2 Did schools restrictions affect all students equally?

In this section we explore heterogeneous effects of the school closings and subsequent shift to remote education by student ability and student socioeconomic characteristics.

We first examine the results by student ability proxied by comprehensive school grades that secondary schools use as the admission criteria. In Figure VII we plot the point estimates and confidence intervals from an exercise where we estimate equation 1 separately for each quantile of the entry grades. Panel (a) shows the results for the Finnish mother tongue test, panel (b) for the advance math and panel (c) for the basic math test. Results from this exercise suggest that there are no differences in the effects of facing more restrictions across the ability distribution in any of the tests. This result is also supported by the coefficients displayed in Table VI columns (3) and (4), where we estimate the effects of school restrictions for those students with scores above and below the median score in the entry to upper-secondary exam.

[11] The 2017 cohort also suffered school closures during their last year in upper-secondary. All schools were closed for 1 month on the 2020 Spring period. We don't study the effect of online learning on students outcomes because as we have no regional variation in the intensity of the restrictions there is no comparison group.

[12] This effects are still small. For example the effect on the Finnish mother tong test represents a 9% of a standard deviation for the 2018 cohort and a 2% of a standard deviation for the 2017 cohort.

To further explore the heterogeneous effects, we partition the data into different groups by variables that are related with the socioeconomic status and the background characteristics from the students. Previous literature has shown that the effects of school restrictions and online teaching can be very different across different socioeconomic groups (Aucejo et al., 2020; Engzell et al., 2021; Rodríguez-Planas, 2022). In Table VI we report the results from this exercise. Panel A reports the results for the Finnish mother tongue test, Panel B for the advance maths test and Panel C for the basic math test. Overall, point estimates suggest that there were no big differences in the effect of school closures across different student groups in any of the subjects. Hence, we cannot conclude that male students of students without a mother that attended university were more severally affected by the restrictions implemented than other students.

6 Discussion and Concluding Remarks

In this paper we have examined the effects of the suspension of on-site teaching due to the Covid-19 related school closures on a high stakes exams in Finland. The matriculation examination results are the main entry criteria to the universities. Currently the Finnish universities choose more than 50% of new students based on Matriculation examination results only.

The matriculation exam is also the only test in the Finnish schooling system that is strictly comparable across schools. The test is implemented in carefully controlled conditions at the same time in all schools and graded by external evaluators. Hence, Matriculation examination is the only test in the Finnish schooling system where effects of a treatment that varies across schools can be reliably evaluated.

Our results suggest that those students who lived in municipalities with more restrictions where not differently affected than those students who lived in municipalities with less or zero restrictions. It is important to note that Finnish schools switched into remote teaching if not overnight then at least within a very short transfer period in the spring 2020. In fall 2020 and spring 2021, the period that we focus on in this study, the Finnish schools already had some experience on remote teaching practices and could perhaps make the transfer more smoothly. Also Finnish schools were generally well prepared for remote teaching.

However, our results are drawn from a selected pool of students. In Finland, around half of each cohort applying to secondary education is accepted to the general track. Hence, our results do not imply that other student at different stages of their educational trajectories were equally affected. In fact, the cohort of student who is more exposed to the restrictions does so in their last year of high-school and just before the exam. It could be that at this stages of their education, a hybrid mode in which they spent more weeks at home allowed them to prepare for the exam as well as if being at the school every day.

Perhaps equally important a factor that may be driving our results is that students were capable of using remote learning methods. In practice, all Finnish secondary school student have broadband access, typically in their smartphones. A generation that lives with youtube-videos and does most of their peer to peer communication using mobile apps is well equipped to convert from on site learning to virtual learning. In other places this transfer was much harder to implement. Other papers have found that the uneven access to online resources in one of the mechanisms behind the learning losses among lowe-income students after the Covid-19 (Bacher-Hicks et al., 2021; Kelli A. Bird, 2020).

Finally, despite we don't find any effect of the length of school closures on students academic performance, it could be that students suffered in other dimensions. For example, it could be that remote learning increases mental health problems or has a negative impact non-cognitive outcomes. Hence, assessing the causal effects of the suspension of on-site classes on other educational and students' outcomes is still needed.

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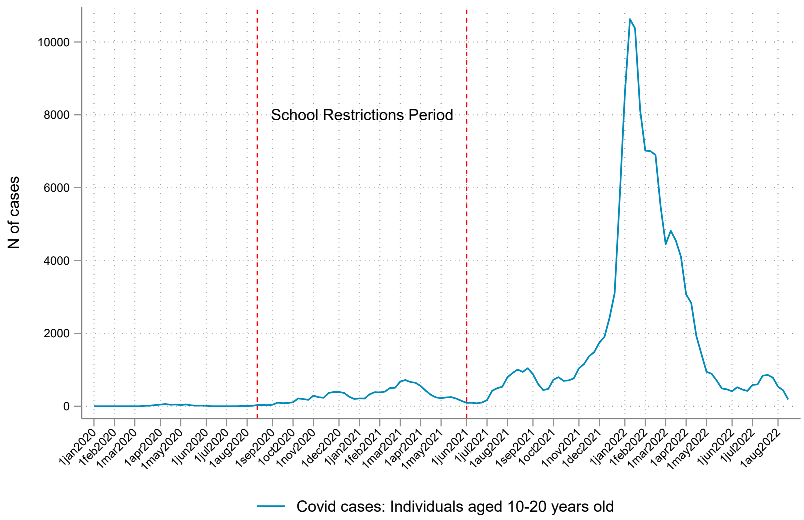
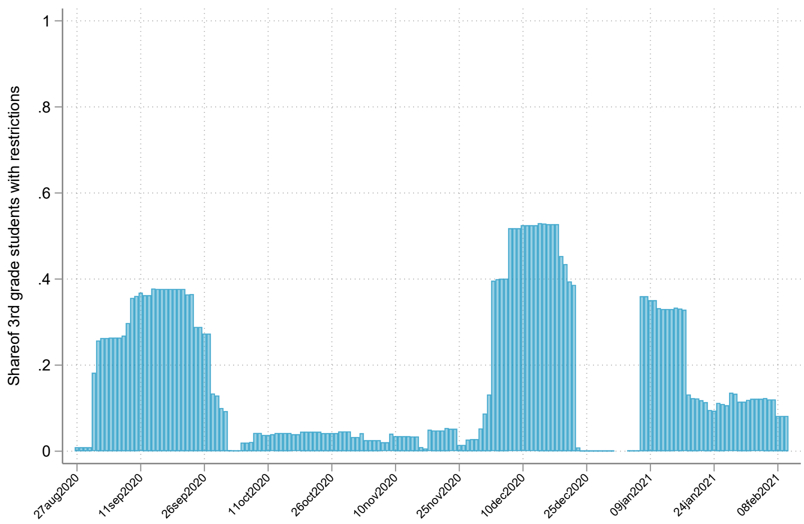
Figure I: Covid-19 and School Restrictions



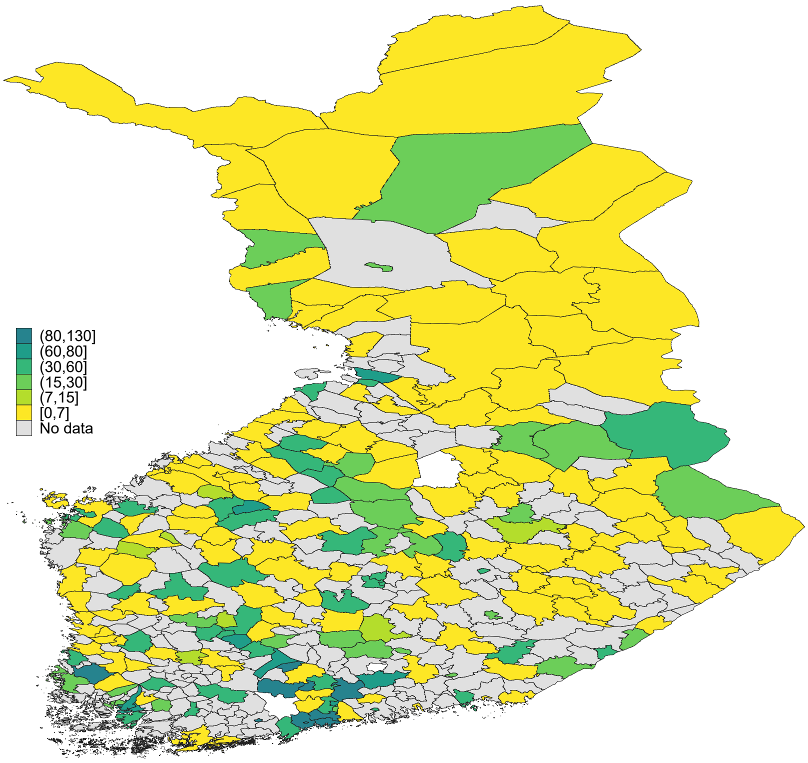
(a) Number of Covid-19 cases per week: Individuals aged 10-20 years old



(b) Share of students not attending school per day

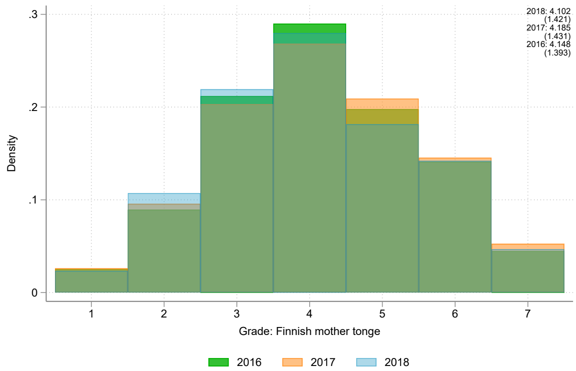
Note: This figure illustrates how Covid-19 cases and the school restrictions evolved in Finland during the period we study. Panel (a) illustrates the evolution of Covid-19 cases for the population aged 10 to 20 years old between the first week of January in 2020 and the third week of August in 2022.The red lines mark the period when school restrictions were implemented. Panel (b) in this figure illustrates the share of third grade students who were not attending school between the fall of 2020 and spring 2021.

Figure II: Number of days with school restrictions per municipality

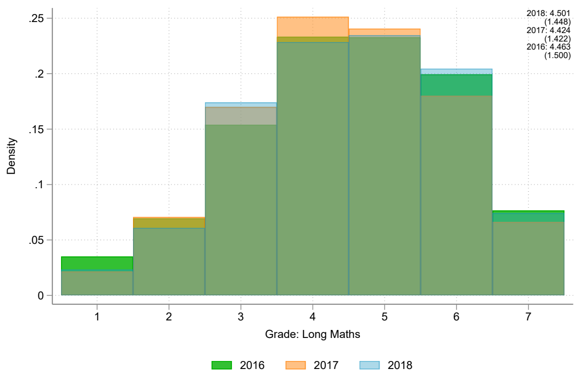


Note: This figure illustrates the distribution of the school restrictions, in number of days, implemented in each municipality during our period of study.

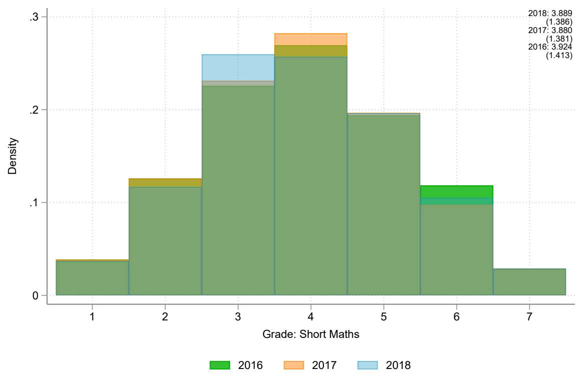
Figure III: Matriculation Exam Grades Distribution by Cohorts



(a) Subject: Finnish Mother Tongue



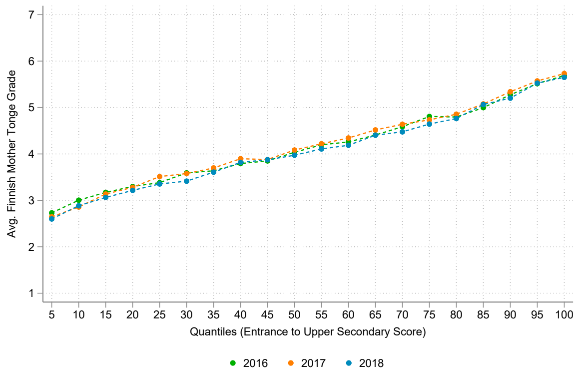
(b) Subject: Advance Math



(c) Subject: Basic Maths

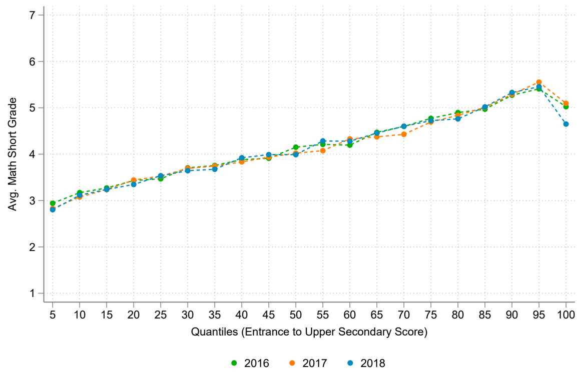
Note: This figure illustrates the distribution of grades from the matriculation exam by cohorts. Cohorts are defined as the year in which students start upper-secondary education. Panel (a) shows the grade distribution from the Mother Finnish Tongue exam. Panel (b) shows the distribution from the Advance Math exams and finally, panel (c) shows the grade distribution for the Basic Maths exams.

Figure IV: Matriculation Exam Grade and Entrance to Upper-Secondary Score



(a) Subject: Finnish Mother Tongue

(b) Subject: Advance Math

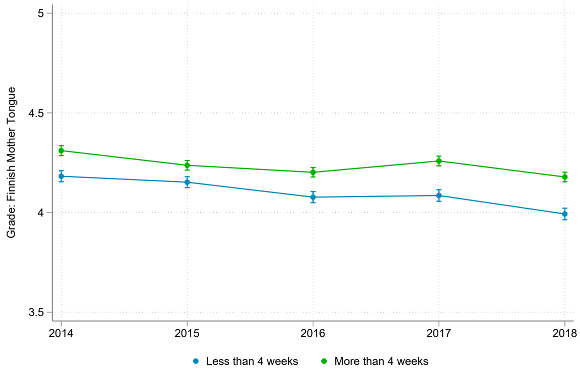


(c) Subject: Basic Maths

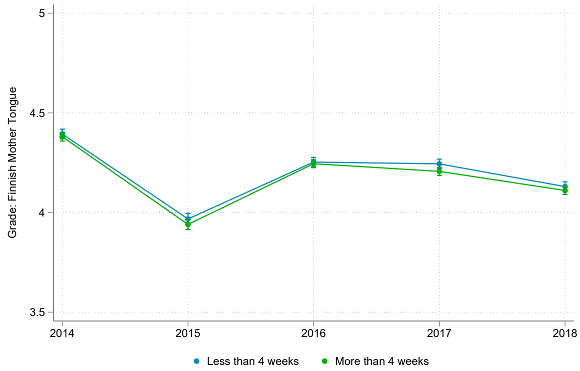
Note: The figure above presents the average grade in the matriculation exams by quantiles defined as students' scores in the entrance to Upper-Secondary exams. Average grades are presented for the cohorts of students starting upper-secondary education in 2016, 2017 and 2018 (the first cohort that can be affected by the Covid-19 restrictions during their matriculation exams). Panel (a) presents average scores for the Finnish mother tongue exam. There are 23,022 students in the 2016 cohort, 22,679 in the 2017 and 22,830 in the 2018. Panel (b) presents average scores for the advance math exam, where there are 11,362 students in the 2016 cohort, 11,980 in the 2017 and 12,209 in the 2018. Finally, panel (c) presents average scores for the basic math exam. There are 10,385 students in the 2016 cohort, 10,643 in the 2017 and 11,120 in the 2018.

Figure V: Paraell Trends

Subject: Finnish Mother Tongue

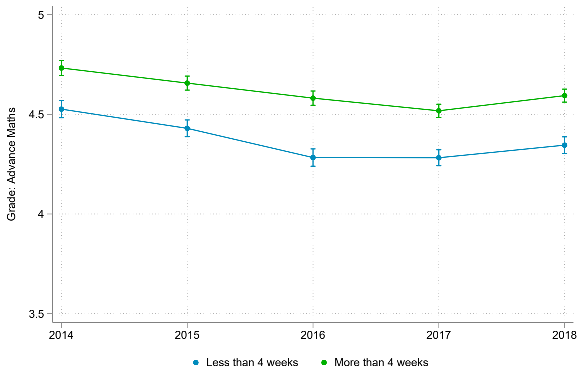


(a) Unconditional Trends

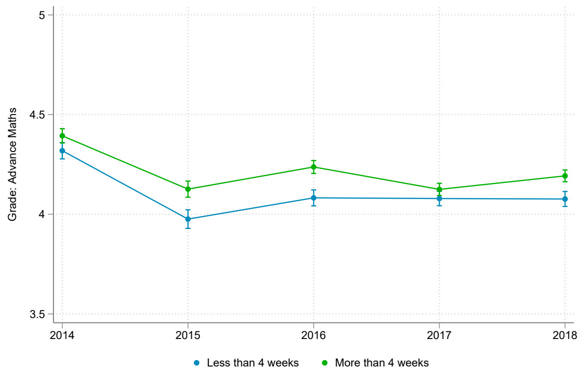


(b) Conditional Trends

Subject: Advance Math

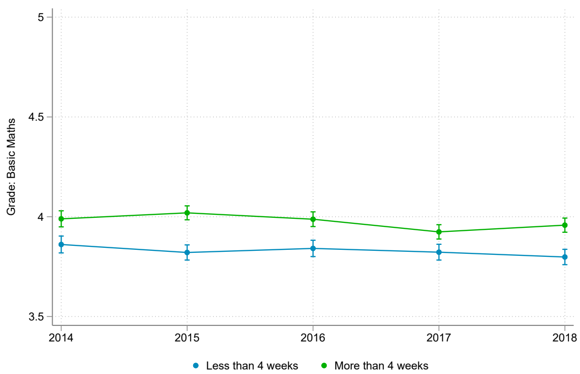


(c) Unconditional Trends

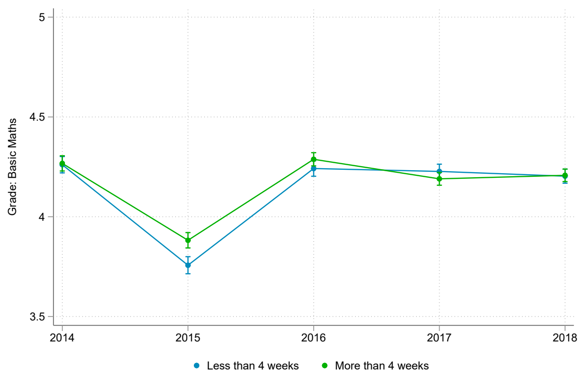


(d) Conditional Trends

Subject: Basic Maths



(e) Unconditional Trends

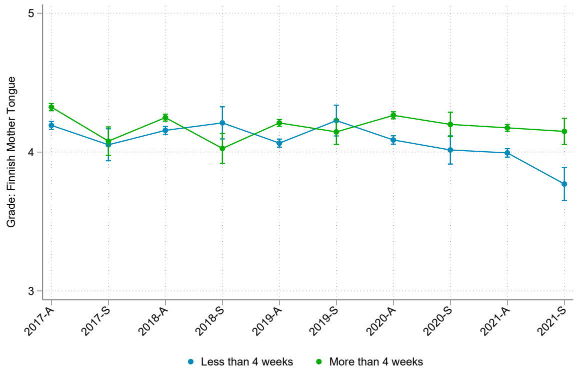


(f) Conditional Trends

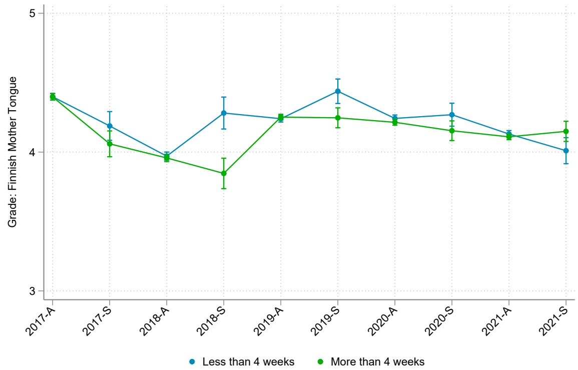
Note: This figure shows the evolution of the average grade across cohorts between those schools who faced more than 4 weeks of restrictions between the fall in 2020 and spring in 2021 (green line) and those schools who faced less than 4 weeks (blue line). Dots represent the point estimates and the bars the 95% confidence intervals. Panel (a) shows the evolution of the average grade in the Finnish Mother Tongue exam, panel (b) in the Advance Math exam and finally, panel (c) in the Basic Math exam.

Figure VI: Paraell Trends

Subject: Finnish Mother Tongue

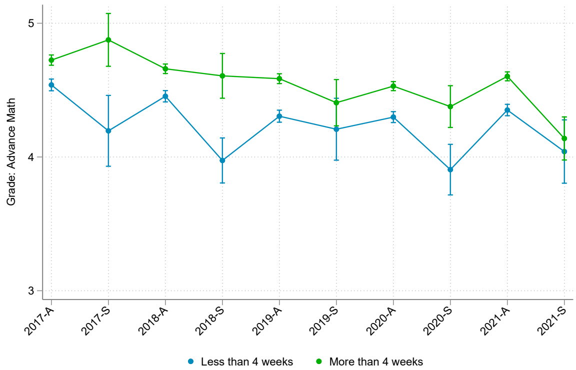


(a) Unconditional Trends

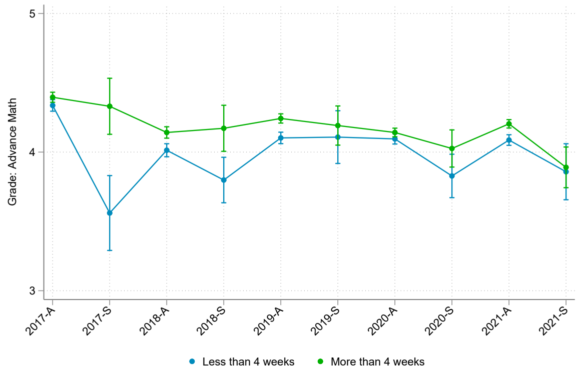


(b) Conditional Trends

Subject: Advance Math

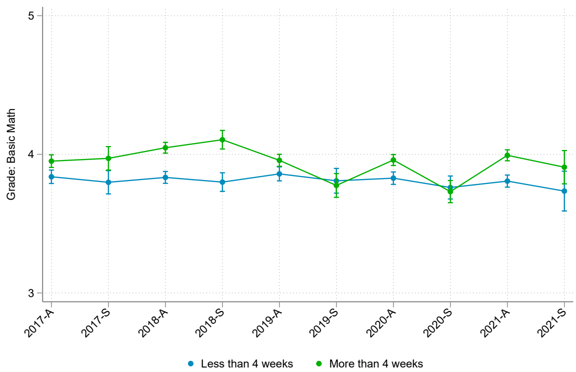


(c) Unconditional Trends

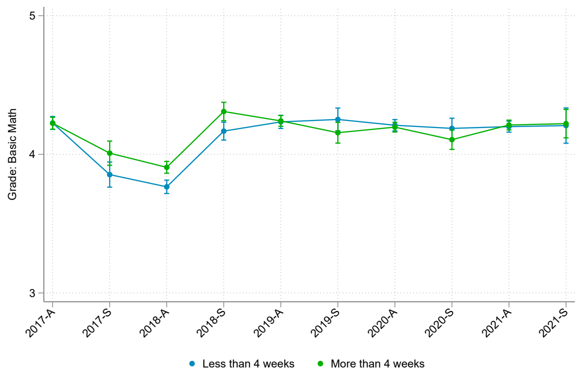


(d) Conditional Trends

Subject: Basic Maths



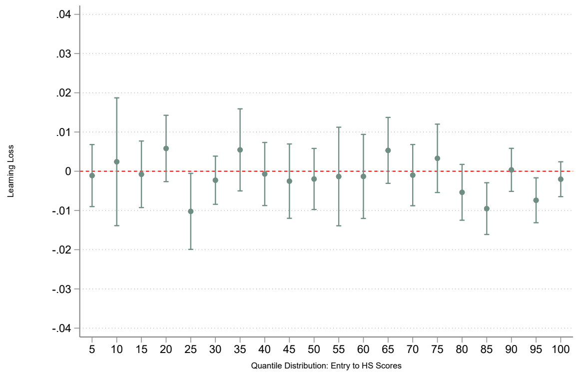
(e) Unconditional Trends



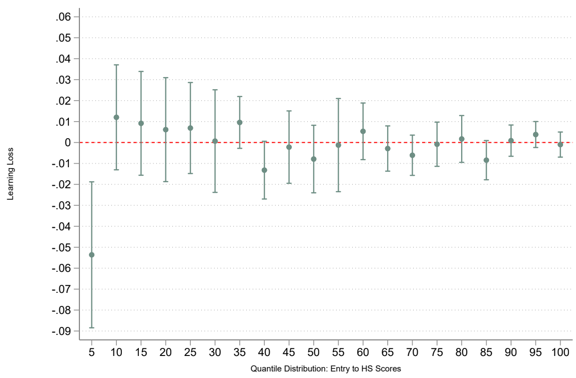
(f) Conditional Trends

Note: This figure shows the evolution of the average grade across examination periods between those schools who faced more than 4 weeks of restrictions between the fall in 2020 and spring in 2021 (green line) and those schools who faced less than 4 weeks (blue line). Dots represent the point estimates and the bars the 95% confidence intervals. Panel (a) shows the evolution of the average grade in the Finnish Mother Tongue exam, panel (b) in the Advance Math exam and finally, panel (c) in the Basic Math exam.

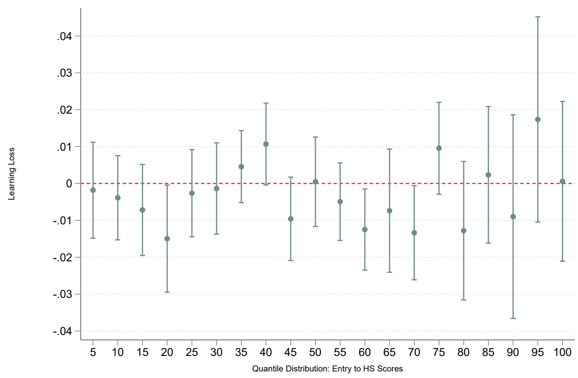
Figure VII: Learning Loss by Student Ability



(a) Subject: Finnish Mother Tongue



(b) Subject: Advance Math



(c) Subject: Basic Maths

Note: This figure illustrates how our estimates of the effect of school restrictions, due to Covid-19, on students' performance in the matriculation exam vary by student ability. Ability is measured with the students' entry to upper-secondary scores. The dots represent the estimated coefficients, and the bars the 95% confidence intervals.

Table I: Summary statistics

	Upper Secondary Cohorts		
	2016 (1)	2017 (2)	2018 (3)
A. Academic characteristics			
Take Matriculation Exam = 1	0.93	0.92	0.92
Avg. Number of Exams	4.88	4.93	4.91
Avg. Number of Mandatory Exams	3.83	3.83	3.82
Avg. Number of Optional Exams	1.43	1.51	1.50
Avg. Entry to Upper-Secondary Score	8.56	8.61	8.62
A. Demographic characteristics			
Female Student = 1	0.57	0.59	0.59
Finnish Nationality =1	0.99	0.99	0.99
A. Socioeconomic characteristics			
Mother: Age in 2019	49.62	48.61	47.66
Mother: Finnish Nationality = 1	0.98	0.98	0.97
Mother: Took Matriculation Exam = 1	0.63	0.63	0.63
Mother: Higher Education = 1	0.43	0.45	0.47
Mother: Employed = 1	0.88	0.88	0.88
Parents: Married = 1	0.69	0.69	0.69
N children in the Family	1.79	2.02	2.16
Age youngest child in 2019	15.46	14.70	13.78
Observations	29510	29371	29907

Note: The table presents summary statistics for the cohorts of students that start upper secondary education in 2016 (Column 1), 2017 (Column 2) and 2018 (Column 3).

Table II: Student Composition in the Matriculation Examination

	Take Matriculation Exam	N of Exams	N of Examns by Spring 3 year	N of Compulsory Exams	N of Optional Exams	N of Exams in Spring	N of Exams in Autumn	Take Advanced Math
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
Number of weeks with restrictions	0.000	0.001	0.000	0.000	0.001	-0.002	0.004**	0.001
	(0.000)	(0.003)	(0.004)	(0.001)	(0.002)	(0.002)	(0.002)	(0.001)
2017 Cohort	-0.009***	0.041***	-0.032	-0.007	0.054***	-0.034***	0.067***	0.008
	(0.002)	(0.013)	(0.020)	(0.006)	(0.010)	(0.013)	(0.009)	(0.005)
2018 Cohort	-0.015***	0.017	-0.094***	-0.010	0.028*	-0.058**	0.046***	-0.003
	(0.003)	(0.022)	(0.029)	(0.010)	(0.016)	(0.023)	(0.016)	(0.009)
School FE	No	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Municiplaity FE	Yes	No	No	No	No	No	No	No
Controls	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Observations	82398	77048	75106	76787	77048	74664	75104	77048

Note: The table present estimates obtained from specification 1 that illustrates the effect of school restrictions on the composition of students in the matriculation examination. All specification controls for student socioeconomic and background characteristics. The set of control variables are: students' gender, entry to high school score, whether the student has the Finnish nationality, whether the mother has the Finnish nationality, a dummy variable equal to 1 if the mother took the matriculation exam, mother education level, employment status and the number of children in the household. Robust standard errors are clustered at municipality level and presented in parentheses.* $p < 0.10$, ** $p < 0.05$, *** $p < 0.01$

Table III: School Restrictions and Performance in the Matriculation Exams: Alternative Cohort Definition

	Finnish Mother Tongue (1)	Finnish Mother Tongue (2)	Advance Math (3)	Advance Math (4)	Basic Maths (5)	Basic Math (6)
Panel A: Restrictions Pooled Together						
N of weeks with school restrictions	0.004	-0.001	0.008	0.006	0.009**	-0.001
	(0.003)	(0.003)	(0.006)	(0.004)	(0.004)	(0.003)
2019 Autumn	0.019	0.110***	-0.110	-0.023	-0.084**	-0.036
	(0.050)	(0.037)	(0.136)	(0.096)	(0.040)	(0.036)
2020 Spring	0.022	-0.041**	-0.056**	-0.081***	-0.023	-0.055**
	(0.021)	(0.018)	(0.023)	(0.021)	(0.021)	(0.022)
2020 Autumn	-0.055	-0.019	-0.254	-0.216	-0.154***	-0.087**
	(0.070)	(0.043)	(0.167)	(0.133)	(0.044)	(0.042)
2021 Spring	-0.084**	-0.138***	-0.028	-0.077*	-0.064*	-0.056*
	(0.033)	(0.026)	(0.050)	(0.042)	(0.038)	(0.032)
2021 Autumn	-0.070	-0.084*	-0.176**	-0.308***	-0.058**	0.021
	(0.059)	(0.049)	(0.081)	(0.062)	(0.052)	(0.049)
Panel B: Restrictions By Term						
N of weeks with restrictions in Autumn	0.006	-0.003	0.009	0.006	0.011*	-0.004
	(0.006)	(0.006)	(0.009)	(0.007)	(0.007)	(0.005)
N of weeks with restrictions in Spring	-0.006	0.006	0.007	0.009	0.003	0.015
	(0.020)	(0.021)	(0.024)	(0.022)	(0.021)	(0.019)
2019 Autumn	0.019	0.110***	-0.110	-0.023	-0.078*	-0.033
	(0.050)	(0.037)	(0.136)	(0.096)	(0.040)	(0.036)
2020 Spring	0.022	-0.041**	-0.057**	-0.081***	-0.022	-0.055**
	(0.021)	(0.018)	(0.023)	(0.021)	(0.021)	(0.022)
2020 Autumn	-0.056	-0.019	-0.255	-0.217	-0.158***	-0.086**
	(0.069)	(0.042)	(0.170)	(0.132)	(0.045)	(0.042)
2021 Spring	-0.089***	-0.136***	-0.032	-0.079*	-0.070*	-0.053
	(0.033)	(0.027)	(0.050)	(0.041)	(0.039)	(0.032)
2021 Autumn	-0.074	-0.081*	-0.178**	-0.309***	-0.068	0.022
	(0.058)	(0.049)	(0.081)	(0.062)	(0.053)	(0.049)
School FE	Yes	Yes	Yes	Yes	Yes	Yes
Controls	No	Yes	No	Yes	No	Yes
Observations	68031	63344	34873	32797	29875	26688

Note: This table present estimates obtained from specification 1 where cohort dummies have been replaced by exam date dummies. It illustrates the effect of school restrictions on the performance in the matriculation exams. Columns (2), (4) and (6) include controls for student socioeconomic and background characteristics. The set of control variables are: students' gender, entry to high school score, whether the student has the Finnish nationality, whether the mother has the Finnish nationality, a dummy variable equal to 1 if the mother took the matriculation exam, mother education level, employment status and the number of children in the household. In Panel (A) we show the results when restrictions are pooled together and in Panel (B) we show the results were we differentiate between the restrictions that were set in the Siring term and the Autumn term. Robust standard errors are clustered at municipality level and presented in parentheses.* $p < 0.10$, ** $p < 0.05$, *** $p < 0.01$

Table IV: School Restrictions and Performance in the Matriculation Exams

	Finnish Mother Tongue (1)	Finnish Mother Tongue (2)	Advance Math (3)	Advance Maths (4)	Basic Math (5)	Basic Math (6)
N of weeks with school restrictions	0.002	-0.002	0.000	0.000	0.006	-0.002
	(0.003)	(0.003)	(0.004)	(0.004)	(0.004)	(0.004)
2017 Cohort	0.018	-0.045***	-0.062**	-0.088***	-0.049***	-0.078***
	(0.021)	(0.017)	(0.024)	(0.023)	(0.018)	(0.020)
2018 Cohort	-0.073**	-0.135***	0.018	-0.047	-0.073**	-0.077***
	(0.033)	(0.026)	(0.044)	(0.039)	(0.034)	(0.030)
School FE	Yes	Yes	Yes	Yes	Yes	Yes
Controls	No	Yes	No	Yes	No	Yes
Observations	67877	63746	35162	33231	31272	29363

Note: This table presents estimates obtained from specification 1. It illustrates the effect of school restrictions on the performance in the matriculation exams. Columns (1) and (2) present the effect of the school restrictions on the Finnish Mother Tongue exam, columns (3) and (4) on the Advance Math exam and finally, columns (5) and (6) on the Basic Math exams. Columns (2), (4) and (6) include controls for the students socioeconomic and background characteristics. The set of control variables are: students' gender, entry to high school score, whether the student has the Finnish nationality, whether the mother has the Finnish nationality, a dummy variable equal to 1 if the mother took the matriculation exam, mother education level, employment status and the number of children in the household. Robust standard errors are clustered at municipality level and presented in parentheses.* $p < 0.10$, ** $p < 0.05$, *** $p < 0.01$

Table V: Before and After Comparison: Performance in Matriculation Exams

	Finnish Mother Tongue	Finnish Mother Tongue	Advance Math	Advance Math	Basic Math	Basic Math
	(1)	(2)	(3)	(4)	(5)	(6)
2018 Cohort	-0.047**	-0.136***	0.039	-0.043	-0.030	-0.085***
	(0.019)	(0.018)	(0.028)	(0.026)	(0.020)	(0.020)
2017 Cohort	0.038*	-0.031*	-0.038	-0.078***	-0.035*	-0.077***
	(0.020)	(0.017)	(0.024)	(0.024)	(0.020)	(0.020)
Controls	No	Yes	No	Yes	No	Yes
Observations	63752	63752	33236	33236	29366	29366

Note: This table present estimates obtained from a specification that compares the performance in the matriculation exams across cohorts. Specifications (2), (4) and (6) control for student socioeconomic and background characteristics. The set of control variables are: students' gender, entry to high school score, whether the student has the Finnish nationality, whether the mother has the Finnish nationality, a dummy variable equal to 1 if the mother took the matriculation exam, mother education level, employment status and the number of children in the household. Robust standard errors are clustered at municipality level and presented in parentheses.* $p < 0.10$, ** $p < 0.05$, *** $p < 0.01$

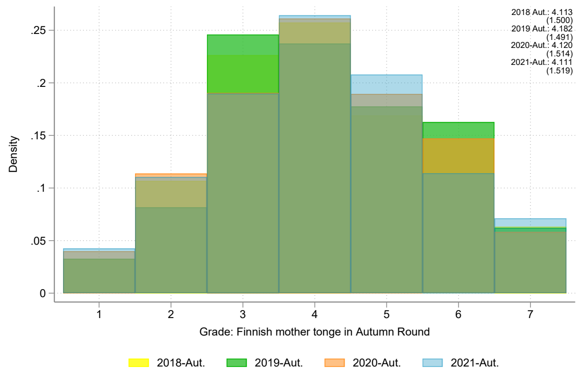
Table VI: School Restrictions and Performance in the Matriculation Exams: Heterogenity

	Student: Female (1)	Student: Male (2)	Entry HS Score Above Median (3)	Entry HS Score Below Median (4)	Mother: Higher Edu. (5)	Mother: No Higher Edu. (6)	Mother: Employed (7)	Mother: Not employed (8)	School Size Above Median (9)	Short Size Below Median (10)
Panel A: Finnish Mother Tongue										
N of weeks with School Restrictions	0.002	-0.006	0.002	-0.004	-0.002	-0.002	-0.002	-0.003	0.001	-0.004
	(0.003)	(0.004)	(0.004)	(0.004)	(0.004)	(0.003)	(0.003)	(0.008)	(0.005)	(0.006)
2017 Cohort	-0.011	-0.092***	-0.002	0.034	-0.048**	-0.042*	-0.042**	-0.098***	-0.039	-0.050**
	(0.017)	(0.026)	(0.027)	(0.021)	(0.019)	(0.021)	(0.018)	(0.034)	(0.027)	(0.024)
2018 Cohort	-0.152***	-0.111***	-0.078**	-0.050*	-0.129***	-0.135***	-0.134***	-0.157***	-0.140***	-0.136***
	(0.027)	(0.036)	(0.037)	(0.029)	(0.031)	(0.030)	(0.027)	(0.056)	(0.048)	(0.034)
School FE	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Controls	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Observations	37020	26721	31224	33008	29955	33786	58208	5528	32239	31479
Panel B: Advance Maths										
N of weeks with School Restrictions	0.004	-0.002	0.004	-0.004	-0.003	0.002	0.001	-0.019	-0.001	0.001
	(0.004)	(0.005)	(0.006)	(0.005)	(0.005)	(0.005)	(0.004)	(0.012)	(0.007)	(0.005)
2017 Cohort	-0.049**	-0.124***	0.018	-0.063***	-0.091***	-0.089***	-0.086***	-0.142**	-0.071**	-0.093***
	(0.022)	(0.033)	(0.042)	(0.021)	(0.026)	(0.028)	(0.022)	(0.054)	(0.036)	(0.031)
2018 Cohort	0.001	-0.105**	-0.061	0.064	-0.005	-0.083**	-0.052	0.046	0.001	-0.088**
	(0.039)	(0.052)	(0.061)	(0.043)	(0.050)	(0.038)	(0.039)	(0.090)	(0.072)	(0.041)
School FE	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Controls	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Observations	16990	16235	10325	23180	17820	15401	30248	2941	16503	16714
Panel C: Basic Maths										
N of weeks with School Restrictions	-0.001	-0.003	-0.002	0.002	0.001	-0.004	-0.001	-0.004	-0.006	0.000
	(0.004)	(0.006)	(0.005)	(0.007)	(0.005)	(0.005)	(0.004)	(0.013)	(0.005)	(0.005)
2017 Cohort	-0.069**	-0.085**	-0.012	-0.029	-0.110***	-0.057**	-0.084***	-0.048	-0.104***	-0.057*
	(0.027)	(0.033)	(0.024)	(0.029)	(0.027)	(0.025)	(0.020)	(0.061)	(0.030)	(0.030)
2018 Cohort	-0.076*	-0.077*	-0.017	-0.027	-0.095**	-0.064	-0.087***	-0.004	-0.058	-0.083**
	(0.039)	(0.045)	(0.036)	(0.060)	(0.042)	(0.039)	(0.031)	(0.096)	(0.042)	(0.041)
School FE	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Controls	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Observations	17326	12018	19106	10424	12363	16977	26633	2696	13664	15680

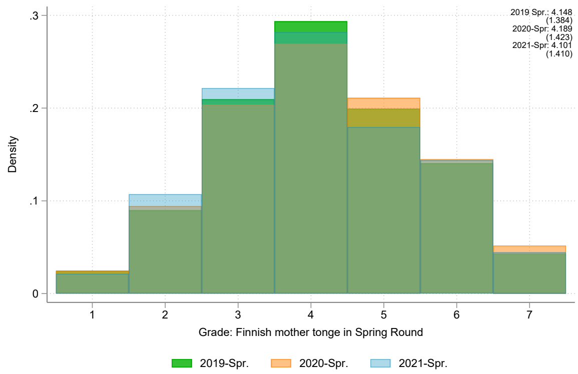
Note: This table presents estimates obtained from specification 1 when we divide the sample into different subgroups. It illustrates the effect of the school restrictions on the performance in the matriculation exams for each of the different subgroups. Panel A focuses on the effects on the Finnish Mother Tongue Exam, panel B on thee Advance Math Exam and finally, panel C on the basic math exam. All specifications include controls for the students socioeconomic and background characteristics. The set of control variables are: students' gender, entry to high school score, whether the student has the Finnish nationality, whether the mother has the Finnish nationality, a dummy variable equal to 1 if the mother took the matriculation exam, mother education level, employment status and the number of children in the household. Robust standard errors are clustered at municipality level and presented in parentheses.* $p < 0.10$, ** $p < 0.05$, *** $p < 0.01$

A Appendix

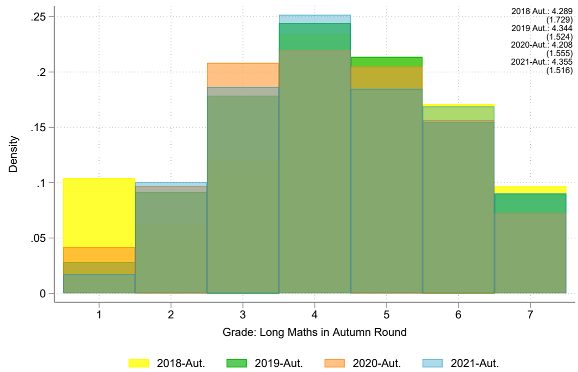
Figure A.I: Grades Distribution by Cohorts



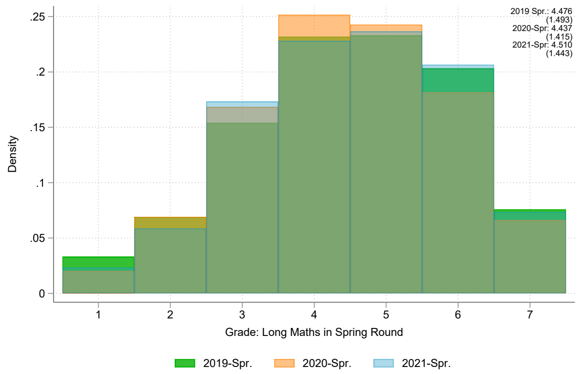
(a) Finnish Mother Tongue in Autumn Term



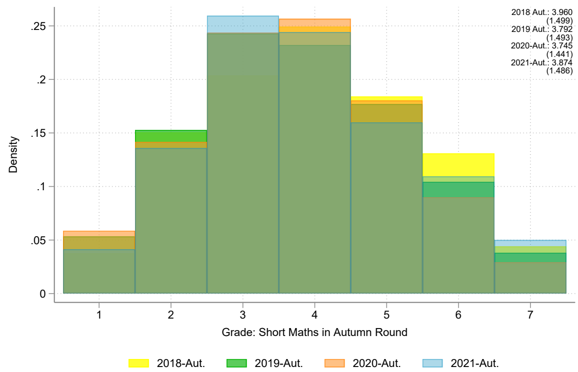
(b) Finnish Mother Tongue in Spring Term



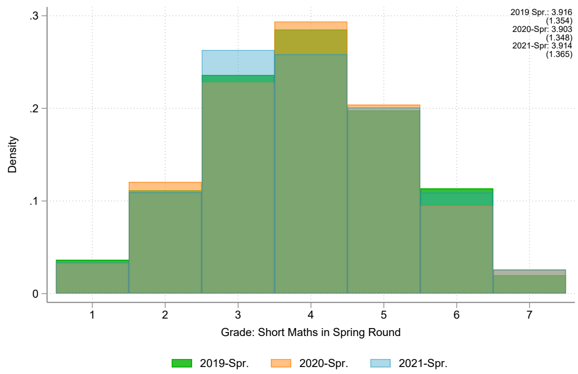
(c) Advance Math in Autumn Term



(d) Advance Math in Spring Term



(e) Basic Maths in Autumn Term



(f) Basic Maths in Spring Term

Note: This figure illustrates the grades distribution on the entrance to university exams by examination term. Panel (a) shows the distribution for the Mother Finnish Tongue exam. Panel (b) shows the distribution for the Advance Math exams and finally, panel (c) shows the grades distribution for the Basic Maths exams.

Table A.I: Summary statistics: Students in Vocational and Academic Tracks

	2016 Cohort		2017 Cohort		2018 Cohort	
	Vocational	Academic	Vocational	Academic	Vocational	Academic
	(1)	(2)	(3)	(4)	(5)	(6)
A. Academic and Demographic characteristics						
N of students	34770	30311	29833	29847	29383	30212
Avg. Entry to Upper-Secondary Score	7.23	8.55	7.25	8.60	7.23	8.62
Female Student = 1	0.43	0.57	0.42	0.59	0.41	0.59
Finnish Nationality =1	0.97	0.99	0.97	0.99	0.95	0.99
B. Socioeconomic characteristics						
Mother: Age in 2019	49.45	49.61	48.11	48.61	46.96	47.67
Mother: Finnish Nationality = 1	0.96	0.98	0.96	0.98	0.95	0.97
Mother: Took Matriculation Exam = 1	0.32	0.62	0.31	0.63	0.30	0.63
Mother: University = 1	0.16	0.41	0.18	0.44	0.18	0.46
Mother: Employed = 1	0.76	0.87	0.76	0.87	0.75	0.87
Parents: Married = 1	0.54	0.68	0.55	0.69	0.54	0.69
N children in the Family	1.59	1.79	1.83	2.02	2.05	2.16

Note: This table presents summary statistics for the cohorts of students that start upper secondary education in 2016 (Columns 1 and 2), 2017 (Columns 3 and 4) and 2018 (Columns 5 and 6). Columns (1), (3) and (5) include students who enter in the comprehensive track while Columns (2), (4) and (6) include students who enter in the academic track.

Table A.II: Student Cohorts and Examination Periods

	Upper Secondary Cohorts				
	2015	**2016**	**2017**	**2018**	2019
	(1)	(2)	(3)	(4)	(5)
Examination Period					
2018 Spring	87192	3170			
2018 Autumn	8,367	44270			
2019 Spring		87163	3566		
2019 Autumn		9468	44466		
2020 Spring			85690	3654	
2020 Autumn			11029	44651	
2021 Spring				86591	3985
2021 Autumn				11814	45408
Total	95559	144071	144751	146710	49393

Note: The table presents the number of students there are in each examination period from each cohort. We allow students to start taking the matriculation exam in the Spring from their second year of High School and allow them to take exam during the 4 subsequent examination periods.