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Children left behind: self-confidence of pupils in competitive environments

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ABSTRACT

To sort pupils at the end of primary school, some early-tracking systems apply a mechanism that unwittingly divides classes into two groups: students preparing for exams to enter better schools and everyone else, who decide not to compete for selective schools. Utilizing TIMSS data and a follow-up study in the Czech Republic, we show that this environment has a detrimental effect on pupils' self-confidence in mathematics, particularly among girls, who do not apply for selective schools but have peers in their classroom who do apply. Our results imply that gender gaps in self-confidence can result from school competitive environments.

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Introduction

Economic literature often relates gender gaps in labor market outcomes to higher male competitiveness driven by their higher self-confidence (Niederle and Vesterlund 2011). Educational research has also shown that one's self-confidence can play an important role in the choice of educational fields and performance during exams (Dean and Fleckenstein 2007; Kinzie, Delcourt, and Powers 1994; Marra et al. 2009). In particular, gender differences in self-confidence contribute to girls' underperformance in math and science exams (Louis and Mistele 2012) and shy them away from competitive educational fields (Niederle and Vesterlund 2007). This is in line with social cognitive theory, which suggests that self-confidence is essential for students' motivations to achieve (Bandura 2001; Zimmerman 2000). Although the importance of self-confidence is well recognized in the social sciences, previous literature has not addressed whether individuals' self-confidence is an inherent trait, or may be also a product of environments induced, for example, by educational systems.[1]

Early tracking processes are high stakes tournaments that produce unequal outcomes in educational attainment because they sort pupils into better or worse schools, purportedly by ability (Betts 2011; Gamoran and Mare 1989). In this context, track placement into a 'better' or 'selective' school means that such schools achieve higher levels of academic performance (e.g. Van de Werfhorst and Mijs 2010), higher rates of college entry (Shavit 2007), and lead to greater job prospects. While substantive research has been conducted on the effects of track placement on subsequent achievement, the literature has ignored how the competitive allocation process itself may impact children left behind, i.e. children who do not apply to selective schools but are nonetheless observers of the process and outcome of the competition.

In this paper, we present evidence using longitudinal data that the competitive process induced by early tracking may negatively affect pupils' self-confidence in mathematics. In particular, we show that having classmates who are applying to a selective school is negatively associated with the self-

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confidence of those who did not apply. This finding is particularly strong for girls and in classes where classmates are successful in the admission process. Our results show that this effect is robust to controlling for GPA, number of slots in selective schools, parental involvement in the application process, self-confidence at the class level or objectively measured math abilities. The decrease in confidence is also slightly stronger when parents do not want their children to apply, which is in line with the fact that parental background and parental decisions play a crucial role in the application process. Our findings contribute to the literature on gender differences in responses to competitive environments (Gneezy, Niederle, and Rustichini 2003; Niederle and Vesterlund 2010), as well as gender differences in inequality aversion, which are particularly acute in early adolescence (Fehr, Bernhard, and Rockenbach 2008; Fehr and Schmidt 1999).

In our set-up, children and their parents have the opportunity to decide whether to apply during the 5th grade to a prestigious academic junior high school, attendance at which brings social prestige, higher quality academic instruction, and better educational opportunities. In fact, 90% of applicants in our sample report that their application decision was driven by the decision of parents.[2] If children do not apply to such schools, they by default continue their studies at an elementary school until the end of compulsory education. The set-up is similar to situations where children apply for placement into classrooms for the 'gifted' or other advanced placement schemes, while children who choose to not apply or who are not accepted maintain their status quo. The children left behind, who do not apply for the academic track, constitute in our case 87% of the school population.

Our empirical strategy uses a longitudinal dataset based on the participants in the TIMSS (Trends in International Mathematics and Science Study) survey in the 4th grade and its follow-up study CLoSE (Czech Longitudinal Study in Education) in the 5th and 6th grades. Based on this panel, we can take advantage of specific questions about pupils' self-confidence, as well as of detailed measures of academic achievement, social and parental background, and classroom characteristics measured at the end of the 4th grade, a time before pupils generally begin preparing for exams or make application decisions. The limitation of our identification strategy is in our inability to control for the pre-treatment specific trend in self-confidence or other time-varying unobserved characteristics that would potential affect change in self-confidence between the 4th and 5th grades.

All pupils in our sample are situated in standardized, non-differentiated classrooms, with school placement based mainly on catchment area. Early in the 5th grade, these pupils then make decisions on whether to apply to academic junior high schools, each of which designs its own entrance exam specific to the school. Our follow-up panel of TIMSS participants was fielded later on in the 5th grade, after application decisions were made and after they received notice of acceptance. Our main outcome variable is the change in self-confidence in mathematics between 4th and 5th (and 6th) grades, that is, before and after the application process is complete.

We focus on the competitive allocation process because such settings may reveal different preferences in the distribution of payoffs – maximin, efficiency or fairness preferences, which has been the subject of intensive debate (Bolton and Ockenfels 2006; Engelmann and Strobel 2004; Fehr, Naef, and Schmidt 2006). In the related literature, child psychologists have shown that competitive environments induce social comparisons among children that lead to negative emotional states, such as envy, gloating or taking delight of someone else's misfortune (Smith and Kim 2007). At the age of 10, children tend to have high inequality aversion and are not willing to take spiteful decisions, which put other children into disadvantaged positions. When children lose, they feel worse about it if others win than when others also lose (Steinbeis and Singer 2013). This is analogical to the situation in early tracking environments when children, who do not apply to selective schools, for example due to the insistence of their parents for the status quo, watch their peers apply and be admitted to selective schools that offer superior educational experiences and prospects. In this case, inequality aversion is not revealed as an ex ante preference, but as an emotional response to the observation of a competitive process with unequal payoffs, which is measured in terms of the reduction in self-confidence of children who are left behind from that competition.

Recent experimental research in economics suggests that there may be important gender differences in inequality aversion, but that these vary greatly by the type and specific parameters of the competitive environment (Andreoni and Vesterlund 2001; Eagly and Wood 1999; Eckel and Grossman 1998; Feingold 1994). The literature seems consistent in finding that, already at an early age, boys respond more positively than girls to winner-take-all tournaments, such as the desire to compete, even if there may not be gender differences in actual performance (Croson and Gneezy 2009). The literature has also found that while preferences for egalitarian distributions increase with age and both girls and boys have similar propensities at age 7–8, boys are less averse against disadvantageous inequality to in-group members, such as classmates, compared to out-group members, while girls' degree of inequality aversion does not vary by in-group or out-group status (Fehr, Bernhard, and Rockenbach 2008).

Lastly, our study on changes in self-confidence as a responsive form of inequality aversion is also motivated by the role of self-confidence as a non-cognitive skill that can significantly affect future academic achievement and employability (Andrews and Higson 2008; Norman and Hyland 2003; Dacre Pool and Sewell 2007). There are also gender differences in the development of soft skills at an early age, with girls exhibiting more responsibility than boys (Montgomery 2005). Heckman and Kautz (2012) have argued strongly in favor of the long-term benefits of soft skills, but they operationalize soft skills one-dimensionally (Big 5 personality traits), without taking into account self-confidence and related concepts. Our study contributes to this literature by examining how competitive environments in a common institutional setting can contribute to changes in self-confidence, and thus the formation of one type of soft skill during the developmental stage of early adolescence.

In the following, we overview the institutional context of our study and the key variables. The empirical strategy specifies the baseline model tested, the results of which are then reported along with empirical extensions that enable us to differentiate the roles of the competitive process on self-confidence, as well as the persistence of the effect in the 6th grade. In the results section we also test for the robustness of the results using a different model of competition and for different controls, such as the role of parents in the application decision or change in GPA. The conclusion assesses the robustness of the results and suggests future directions for follow-up studies.

Institutional background and data

The Czech Republic as well as many other, especially Central European, countries provide pupils with the possibility to transfer to elite junior high schools (8-year gymnasia) after the completion of primary education in the 5th grade, i.e. usually around the age of 11. This system of early tracking is based on the German model of education, which has been a focal point of research on educational efficiency and inequality (Hanushek and Woessmann 2006; Heubert and Hauser 1998; Woessmann 2010) and which some scholars regard as the most stratified in the world (Buchmann and Park 2009; Phillips 2000). This model is characterized by a highly differentiated system of secondary education offering vocationally specific apprentice programs, which are dead-end tracks that provide pupils with focused labor market opportunities but not credentials needed for tertiary education. In order to avoid ending up in dead-end tracks, and thus limited future educational and labor market prospects, many Czech children (and their parents) aim to enter elite junior high schools at the earliest opportunity, i.e. the application process in the 5th grade.

This early-tracking school system can be contrasted with comprehensive school systems, such as in Finland, in which all pupils are educated in one school track up to the age of 15 or 16, or other standardized school systems, such as in the United States, England, or South Korea, where primary and middle schools (up to the age of 15 or 16) offer relatively standardized curricula for all students. In the early-tracking school system, since the allocation to the academic track is non-random, early tracking introduces selection in the schooling process at very early age, particularly by family background (Betts 2011; Brunello and Checchi 2007). When compared, for example, to the Taiwanese system of education, which is relatively stratified but lacks dead-end tracks, the Czech educational

system produces systematically larger inequalities in educational attainment by family background, particularly in terms of complete secondary education (Smith et al. 2016).

This paper focuses on the Czech school system in which pupils in the 5th grade have an option to apply to academic junior high schools. These are widely regarded as the most prestigious public schools in the country. Acceptance into these schools is highly predictive of future university attendance and high occupational and income status, and is strongly determined by family background (Greger 2015). Typically, slightly less than 20% of pupils apply to these schools and more than half are admitted, such that about a tenth of former fifth graders end up in this academic track in the next school year. Pupils who did not apply or were not admitted continue in the same track up to the end of lower secondary education, i.e. up to the 9th grade. Pupils who apply have to usually pass the high-stake entrance exams that are administered at the end of April. The admission decision is then based on results from entrance exams and on the primary school grade point average (GPA). Although the application decision is announced before mid-March, there is evidence that pupils start preparing for entrance exams, usually through demanding private courses, already at the beginning of the school year in September. Indeed, about half of all pupils who apply to academic junior high schools dedicated some time almost every day to preparing for entrance exams in the semester beforehand. Thus, at least 6 months before the entrance exams, fifth graders are divided into two groups: those who are applying, and thus preparing to take the entrance exams, and those who are not.

To examine the effect of this class division on students' self-confidence, we explore Czech panel data collected before and after the selection process in the 5th grade. The panel data consists of two datasets, the international TIMSS survey held in 2011 and its follow-up study, CLoSE (Czech Longitudinal Study in Education). TIMSS tests a nationally representative sample of pupils in the 4th grade in math and science in four-year cycles. Together with these test scores, TIMSS collects school, parental, and student questionnaires that provide detailed information about pupils' school and socio-economic background as well as their perception of their own study aptitudes. The sample of Czech fourth graders tested by TIMSS in 2011 then completed the CLoSE survey in the 5th grade, which focused on the application, preparation and admission process of pupils. Of 4578 students TIMSS 2011, 3681 students were followed up by the CLoSE survey in the 5th grade.[3]

To test for whether panel attrition is selective on our key variables, we compared the descriptive statistics between all 4578 Czech pupils participating in TIMSS and those who participated in TIMSS but did not participate in the follow-up study. We found no evidence of selective attrition. For example, both the mean and standard deviation of our key 4th grade self-confidence variable are nearly identical for all three samples. The mean school grades that pupils received from their teachers in the 4th grade are also nearly identical across the populations as well. In terms of the TIMSS math score, pupils participating in the follow-up study perform only slightly better than those who did not participate in the follow-up, but the difference is far within the standard error as to be meaningless.

Self-confidence measure

The challenging process of preparing for and dealing with the prospects of success or failure in high-stakes entrance exams affects not only those who applied but all students in the class. Different degrees of competition, indicated by the number of students in each class taking part in the entrance exams, can alter the self-confidence of those students who are left behind. The surveys in both the 4th and the 5th grades asked pupils to self-assess their own performance in mathematics (i.e. *Do well in math*). In the 4th grade, this is indicated by pupils' responses to the statement 'I usually do well in mathematics' and in the 5th grade to the statement 'I was always good at math.' The response categories to these statements in both surveys are based on the same 4-point scale: *Agree a lot* = 1, *Agree a little* = 2, *Disagree a little* = 3, and *Disagree a lot* = 4.

To facilitate the interpretation of results, in the empirical analysis we converted the self-confidence measure into a dichotomous variable indicating low or high levels of self-confidence (any agreement

with the self-confidence question was coded as 1, any disagreement as 0). This transformation enables us to classify those who changed their self-assessment from high to low between the 4th and 5th grades as negative switchers of self-confidence. Figure 1 depicts the change in pupils' self-confidence between the 4th and 5th grades with respect to the degree of change in classes with no applicants. For boys, the data suggests there is no change in self-confidence by the competitive level of the class. However, girls in classes with more than two applicants experience an unconditional decline in their self-confidence by about 8 p.p. relative to girls in classes with no applicants.

Regarding the number of admitted pupils in the class, Figure 2 depicts the change in self-confidence across classes with different numbers of admitted pupils in comparison to those classes in which no one was admitted, and hence, no one is leaving the class.[4] Although boys with a higher number of admitted pupils in their class have a higher relative increase in self-confidence, this change does not statistically differ with respect to boys in classes with no admitted classmates. On the other hand, girls seem to be prone to declines in their self-confidence according to the number of admitted pupils in the class.

Assessment data

Two academic assessment measures are available in the data: the math test score[5] collected in the 4th grade by TIMSS, and the GPA[6] that pupils received in the 4th and 5th grades. Descriptive statistics of these measures for non-applicants – as well as of other individual and class characteristics – are presented in Table 1. Among non-applicants, boys outperform girls in the math test score by nearly 0.2 standard deviations, while girls receive better grades than boys in math and in the overall GPA in both the 4th and 5th grades. Pupils' socio-economic background – measured by the share of pupils with parents with a university education – is evenly distributed for non-applying boys and girls. The means in the self-confidence variables increase between the 4th and 5th grades, which indicates a decline in pupils' self-confidence. Moreover, girls not only have lower self-confidence in math than boys in the 4th grade (a trend common in the majority of countries participating

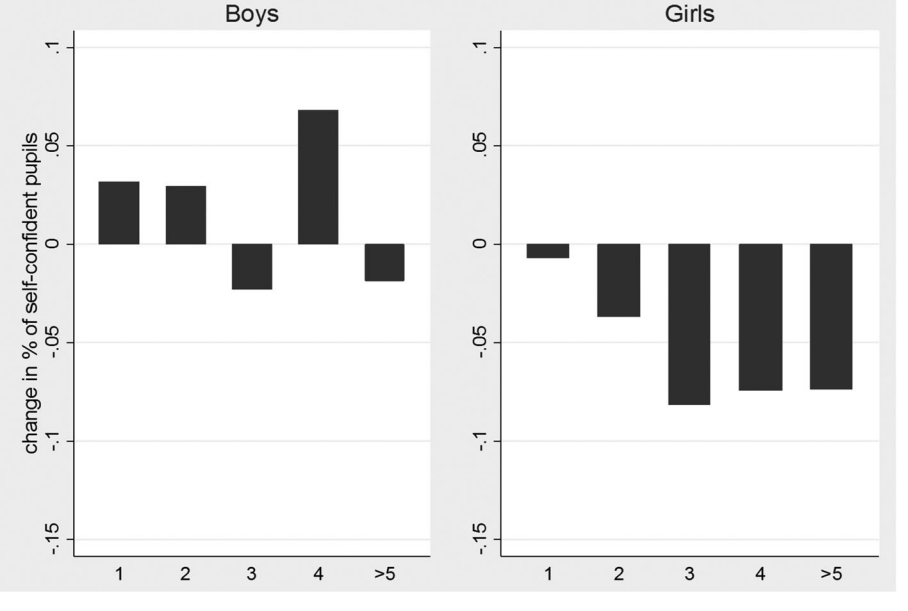

Figure 1. Change in the self-confidence of pupils who did not apply with respect to the change in classes with no applicants, by the number of applicants in the class

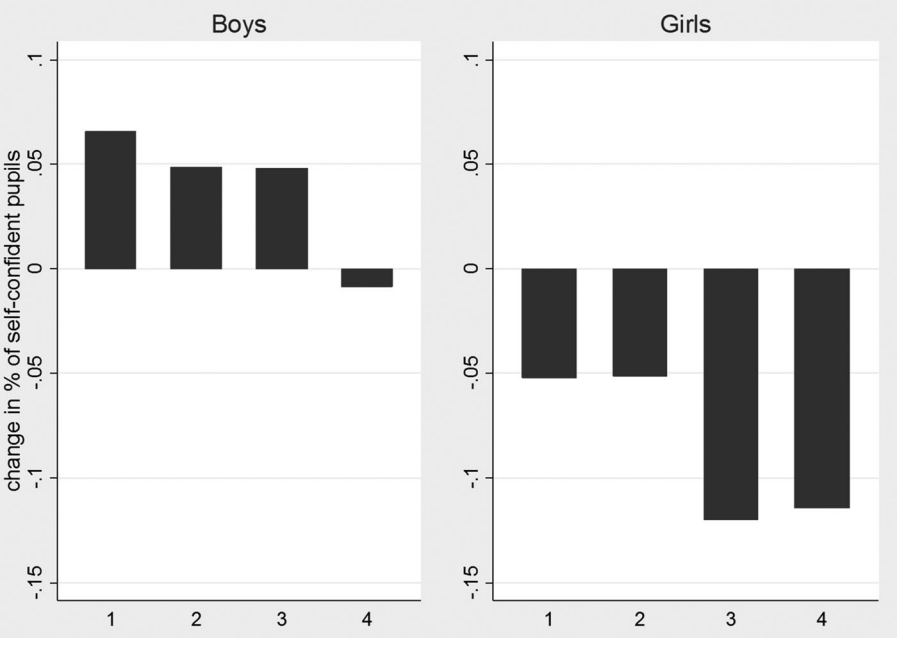

Figure 2. Relative change in the self-confidence of pupils who did not apply (normalized by the change in classes with no admitted pupils), by the number of admitted pupils in the class

in TIMSS), but they also experience a larger decline between the 4th and 5th grades that leads to even greater gender differences in self-confidence in the 5th grade.

Regarding the selection process, on average three pupils in each class apply to academic junior high schools and nearly two are admitted. Non-applying girls experience a slightly more competitive environment than boys in terms of the number of applicants and the success rate of their classmates.

Table 1. Descriptive statistics of individual characteristics by gender, only for pupils who did not apply.

	Non-applicants		
	All	Girls	Boys
% boys	52.66		
Age	10.38 (.422)	10.31 (.396)	10.45 (.436)
Math score (see footnote 5)	−.145 (.975)	−.249 (.956)	−.051 (.982)
GPA – 4th grade (see footnote 6)	1.72 (.665)	1.63 (.616)	1.80 (.697)
GPA – 5th grade (see footnote 6)	1.99 (.775)	1.87 (.740)	2.09 (.793)
Math grade-4th	1.68 (.752)	1.67 (.727)	1.69 (.774)
Math grade-5th	1.94 (.868)	1.91 (.832)	1.95 (.899)
Father – university education	12.4% (33.0)	11.1% (31.4)	13.7% (34.4)
Mother – university education	10.4% (30.5)	10.0% (30.0)	10.7% (30.9)
Self-confidence – 4th grade	.85 (.357)	.82 (.384)	.88 (.328)
Self-confidence – 5th grade	.67 (.472)	.57 (.495)	.75 (.433)
Self-confidence – 6th grade	.70 (461)	.61 (.487)	.77 (.423)
Learn quickly math – 4th grade	1.94 (.936)	2.09 (.941)	1.81 (.910)
Learn quickly science – 4th grade	1.95 (.909)	1.92 (.864)	1.98 (.946)
Do well science – 4th grade	1.73 (.817)	1.72 (.779)	1.75 (.850)
Enjoy math – 4th grade	1.86 (.966)	1.94 (.956)	1.79 (.971)
Class size	17.5 (5.4)	17.8 (5.4)	17.2 (5.5)
Number of applicants in own class	2.5	2.7	2.3
Number of admitted pupils in own class	1.6	1.7	1.5
Parents didn't want me to apply (% of non-applicants)	56.9	58.1	55.8
N	2945	1422	1523

Note: Standard deviations are in parenthesis.

Lastly, a greater share of girls report that their parents did not want them to apply, possibly due to cultural norms, risk of failure, prevention of stress, and other factors.

Empirical strategy

In our estimation approach, we employ the level of self-confidence in the 5th grade as our main left hand side variable. The variable is dichotomous, referring to high or low levels of self-confidence in mathematics. The key right hand side variables are set of dichotomous dummies indicating the number of classmates applying to junior academic high schools. For subsequent analyses, we also constructed a success rate dummy as the share of successful applicants in a class. The main control variables are the level of self-confidence in the 4th grade, GPA in the 4th grade, the TIMSS math score indicating math ability, parental education (two dummies for whether each completed tertiary education), gender, and age. We also control for commensurate classroom characteristics (class averages in 4th grade TIMSS math scores, 4th grade GPA, and 4th grade self-confidence, and the number of pupils in the class). Lastly, we also include additional attitudinal variables ('indexes' in Table 2) as controls that relate to math and science achievement: whether the pupil reports doing well in science, learning things quickly in science, learning quickly in math, and enjoying math.

For our analysis, we employ both probit and linear probability models, and compare the coefficients as a matter of robustness. Because we find that the results for both models are substantively identical, we mainly report the LPM results due to their ease of interpretation and the computational tractability of the model. The model can thus be expressed in the simple form:

$$y_{i,t,c} = \alpha + \beta y_{i,t-1,c} + \#\,\text{applied}_{t,c} + X_{i,c} + X_c + \varepsilon_{i,t,c}$$

where the self-confidence y of pupils i in classrooms c in grade t (i.e. the 5th grade) is predicted by those pupils' self-confidence in the 4th grade (t-1), the set of dichotomous dummies indicating the number of classmates applying to junior academic high schools (*#applied*), the vectors of both individual and family characteristics of the pupil as well as classroom characteristics X, and the error term. We also run the model separately for boys and girls, as well as together, in which case gender is included in the model. As we apply variables that vary across classes, in all regressions we cluster standard errors at the class level.

This identification strategy has certain limitations. We cannot employ a control group that is not affected by the application process to eight-year junior high schools. All 5th grade pupils are affected by the competitive environment, regardless of their behavior towards it. From that reason we cannot control for different trends in self-confidence in classes with a high application rate and a low application rate, for example.

One identification issue of our setup is thus the degree to which our control variables can explain the potential sorting of students into classes and schools, where change in the number of applied students and change in self-confidence can be driven by common unobserved factors. To address this issue, we show that by including our control variables at the individual and class levels, self-confidence is not significant in the application decision (see Appendix 1). Although we may not be able to explain the whole application decision by our control variables, we are able to control for the part that is correlated with our dependent variable, i.e. the measure of self-confidence.

We also analyzed to what extent our control variables explain variation in the number of applied students in the class. As shown in Appendix 2, we explain 40% of this variation and more importantly, the unexplained part of the number of applicants in a given class is not correlated with class level self-confidence in the 4th grade. This suggests that our control variables are able to capture some part of the ex-ante association between the pre-treatment level of self-confidence and the number of applicants across classes.

Table 2. Change in the self-confidence of pupils who did not apply, LPM and marginal effects from Probit.

	LPM			Probit		
Self-confidence (5th grade)	All	Girls	Boys	All	Girls	Boys
Number of applicants						
1	−0.014	−0.024	−0.006	−0.014	−0.030	−0.003
	(0.032)	(0.049)	(0.042)	(0.033)	(0.049)	(0.042)
2	−0.016	−0.064	0.036	−0.016	−0.069	0.034
	(0.040)	(0.052)	(0.056)	(0.040)	(0.052)	(0.053)
3	−0.060*	−0.090*	−0.034	−0.058*	−0.087*	−0.039
	(0.034)	(0.046)	(0.040)	(0.034)	(0.045)	(0.041)
4	−0.032	−0.115**	0.043	−0.033	−0.115**	0.040
	(0.040)	(0.053)	(0.043)	(0.039)	(0.051)	(0.044)
5 or more	−0.069**	−0.085*	−0.056	−0.071**	−0.088**	−0.060
	(0.034)	(0.046)	(0.043)	(0.033)	(0.045)	(0.043)
Indexes – 4th grade						
Self-confidence	0.113***	0.129***	0.074*	0.076***	0.114***	0.025
	(0.030)	(0.040)	(0.044)	(0.025)	(0.037)	(0.033)
Learn quickly math	−0.074***	−0.099***	−0.048**	−0.064***	−0.089***	−0.042***
	(0.014)	(0.019)	(0.019)	(0.012)	(0.017)	(0.015)
Learn quickly science	0.016	0.018	0.015	0.013	0.015	0.011
	(0.012)	(0.017)	(0.017)	(0.011)	(0.017)	(0.016)
Do well science	−0.004	−0.009	−0.000	−0.004	−0.010	0.001
	(0.013)	(0.018)	(0.017)	(0.012)	(0.018)	(0.016)
Enjoy math	−0.102***	−0.098***	−0.107***	−0.093***	−0.096***	−0.092***
	(0.012)	(0.019)	(0.017)	(0.010)	(0.017)	(0.014)
Individual characteristics						
4th grade math score	0.061***	0.053***	0.069***	0.063***	0.053***	0.072***
	(0.011)	(0.018)	(0.015)	(0.011)	(0.017)	(0.014)
4th grade GPA	−0.127***	−0.126***	−0.126***	−0.118***	−0.125***	−0.104***
	(0.017)	(0.027)	(0.022)	(0.015)	(0.026)	(0.019)
University education – father	0.003	−0.031	0.041	0.000	−0.028	0.032
	(0.025)	(0.039)	(0.032)	(0.025)	(0.039)	(0.033)
University education – mother	−0.015	0.008	−0.048	−0.013	0.002	−0.040
	(0.029)	(0.040)	(0.038)	(0.029)	(0.039)	(0.039)
Gender (Boy = 1)	0.115***	–	–	0.115***	–	–
	(0.019)			(0.018)		
Age	−0.029	−0.042	−0.021	−0.026	−0.041	−0.018
	(0.021)	(0.032)	(0.026)	(0.021)	(0.032)	(0.025)
Class characteristics (4th grade)						
Class GPA	−0.023	0.037	−0.090*	−0.019	0.044	−0.086*
	(0.041)	(0.055)	(0.049)	(0.041)	(0.054)	(0.048)
Class score – math	−0.080***	−0.061	−0.097***	−0.081***	−0.060	−0.097***
	(0.028)	(0.040)	(0.033)	(0.028)	(0.039)	(0.033)
Class self-confidence	0.010	0.046	−0.038	0.018	0.039	−0.022
	(0.107)	(0.162)	(0.109)	(0.102)	(0.142)	(0.110)
Class count	0.000	0.002	−0.002	0.000	0.002	−0.001
	(0.002)	(0.003)	(0.003)	(0.002)	(0.003)	(0.003)
N	2479	1216	1263	2479	1216	1263
R^2	0.265	0.255	0.248			

Note: Standard errors robust to clustering at the class level in parentheses (*$p < 0.1$, **$p < 0.05$, ***$p < 0.01$).

Results

Our main results are summarized in Table 2. In order to measure the change in self-confidence for those who did not apply to academic junior high schools, we apply firstly the linear probability model presented in the first three columns. Controlling for individual and average class scores in math, as well as other individual characteristics described above, Column 1 reveals that self-confidence declines with the increasing number of applicants in class. Thus, those pupils who did not apply and experience a high level of competition in their class (i.e. class with five and more pupils who applied) have on average a 7% higher probability of experiencing a decline in self-confidence compared to pupils in classes with no applicants. Dividing pupils by gender in Columns 2 and 3, the results indicate that this decline in self-confidence is experienced by girls in all modeled situations

where there are at least three applicants in the classroom, whereas the competitive level of the class seems to have no measurable effect on the self-confidence of boys. For girls, the probability of experiencing a decline in self-confidence between classes with three and more applicants and no applicants is about 10%.

The individual characteristics used as control variables in the model have the expected signs in all regressions: self-confidence and math score in the 4th grade positively affect the self-confidence in the following grades, whereas a higher grade average in the 4th grade decreases the self-confidence; boys are more likely to report self-confidence than girls, and parents' education seems to have no impact on pupils' self-confidence.

The second part of Table 2 summarizes the results of marginal effects according to the Probit model. In the substantively same way as the linear probability model, the results show a significant decline in the self-confidence of pupils with the increasing level of competition in the class. Again, girls seem to be particularly affected by this class environment.

In our main specification, the variable of interest is the absolute size of the group of applicants in each class. We control for the class size in order to take into account the proportion of the class that applied for academic junior high schools. However, it is not clear a priori whether the absolute or relative size of the group of applicants affects the self-confidence of those who did not apply. To resolve this issue, we further provide a robustness check on our results and control for the relative application rate instead of the absolute number of applicants in class. This approach leads to the results in the same direction as the results with the absolute number of applicants, and confirms the negative effect of the increasing application rate on the self-confidence of non-applicants. The results are presented in Appendix 3. However, using the relative application rate, boys also experience a negative effect of the number of applications on their self-confidence. However, this effect is slightly smaller compared to girls. Because of the ordinal nature of the relative size of the group of applicants, as well as to interpret the results more clearly, we continue the analysis using the absolute measure of applicants in each class.

Since our self-confidence measure is context-driven, we apply an additional robustness check to our main specification. To check the sensitivity of the results on other school or regional background variables, we additionally control for school location, which is operationalized in terms of five dummy variables ranging from urban areas to remote rural areas. As we show in Appendix 4, the results are very similar to the ones in the main specification in Table 2. The increasing number of applicants still contributes to a significant decline in self-confidence; the results again confirm that the overall effect is driven mostly by girls.

This decline in self-confidence may be triggered by several different mechanisms, such as the natural increase in competition in class, the departure of classmates/friends from class, a more demanding teacher policy due to the entrance exams to academic junior high schools (especially in classrooms where more pupils are preparing to apply for those exams), and other factors. Our subsequent models are designed to tease out which of these mechanisms may be driving our results, and to detect the qualities of pupils that are mostly likely to be affected by this early-tracking school policy. As mentioned above, because LPM and probit models yield similar results, for the sake of simplicity we hereinafter present the results only for LPM.

We continue by differentiating the effect of the class environment, in which peers are preparing for the demanding entrance exams, and the effect of payoffs, caused by the loss of classmates at the end of the school year due to their success in the entrance exams. The coefficients for payoffs can be potentially seen as expressions of inequality aversion, as it is a direct response to the future sorting of classmates into selective and status quo schools.

In Table 3, we take the model summarized in Table 2 and add a variable on the success rate of applicants by class and interact it with dummy variables representing the number of applicants. This approach enables us to differentiate two mechanisms of change in self-confidence due to, for example, the competitive process (i.e. classmates preparing for exams) and the effect of classmates leaving the class. Since the success rate is zero across our previous reference group, i.e. no one is

Table 3. Change in the self-confidence of pupils who did not apply, controlling for the number of applicants in the classroom and their success rate in exams.

Self-confidence (5th grade) (0–1 reference group)	(1) All	(2) Girls	(3) Boys
Number of applicants in class			
2	−0.079	−0.004	−0.130
	(0.095)	(0.086)	(0.133)
3	−0.106**	−0.156*	−0.058
	(0.053)	(0.086)	(0.068)
4	0.074	−0.044	0.140**
	(0.073)	(0.103)	(0.069)
5 or more	−0.031	−0.050	−0.009
	(0.080)	(0.102)	(0.091)
Number of applicants interacted with success rate			
2 * success rate	0.128	−0.003	0.258
	(0.114)	(0.121)	(0.164)
3 * success rate	0.100	0.166	0.033
	(0.077)	(0.116)	(0.093)
4 * success rate	−0.137	−0.041	−0.159
	(0.101)	(0.134)	(0.107)
5 or more * success rate	−0.028	0.012	−0.072
	(0.112)	(0.148)	(0.135)
Success rate	−0.050	−0.110**	0.003
	(0.033)	(0.050)	(0.047)
Other indexes – 4th grade			
Self-confidence	0.112***	0.129***	0.074*
	(0.030)	(0.040)	(0.045)
Learn quickly math	−0.074***	−0.100***	−0.047**
	(0.014)	(0.019)	(0.019)
Learn quickly science	0.016	0.018	0.013
	(0.012)	(0.017)	(0.017)
Do well science	−0.004	−0.006	0.001
	(0.013)	(0.018)	(0.017)
Enjoy math	−0.102***	−0.098***	−0.109***
	(0.012)	(0.019)	(0.017)
Individual characteristics			
4th grade math score	0.061***	0.054***	0.069***
	(0.011)	(0.018)	(0.015)
4th grade GPA	−0.127***	−0.124***	−0.126***
	(0.017)	(0.027)	(0.022)
University education – father	0.002	−0.031	0.040
	(0.025)	(0.039)	(0.033)
University education – mother	−0.016	0.012	−0.049
	(0.029)	(0.039)	(0.038)
Gender (Boy = 1)	0.115***		
	(0.018)		
Age	−0.032	−0.047	−0.020
	(0.021)	(0.032)	(0.026)
Class characteristics (4th grade)			
Class GPA	−0.023	0.024	−0.087*
	(0.042)	(0.054)	(0.050)
Class score – math	−0.074***	−0.059	−0.094***
	(0.028)	(0.039)	(0.034)
Class self-confidence	0.033	0.071	−0.030
	(0.111)	(0.162)	(0.116)
Class count	0.001	0.003	−0.001
	(0.002)	(0.003)	(0.003)
Constant	1.391***	1.421***	1.586***
	(0.307)	(0.449)	(0.360)
N	2479	1216	1263
R^2	0.268	0.260	0.255

Note: Standard errors robust to clustering at the class level in parentheses (*$p < 0.1$, **$p < 0.05$, ***$p < 0.01$).

accepted in classes where no one applied, we have to include into the control group also classes with one applicant, so that the success rate varies. Table 3 summarizes these results. After controlling for both the success rate and the number of pupils in the classroom who applied, the overall effects for boys and girls together (in the first column) are insignificant in almost all cases.

This, however, masks key gender differences expressed in Columns 2 and 3. The dummy variables for the number of applicants now represent the effect for classes where no one was accepted, and hence, may signal the effect of competition per se. For girls, this effect is still negative and marginally significant. On the other hand, results for boys are difficult to interpret as the coefficient varies in sign across the number of applicants in class. Regarding the effect of departing classmates, expressed in the regression by success rate, it is insignificant for both boys and girls when interacted with the number of applicants. Hence, its effect does not vary across classes with more or less applicants. However, the effect of departing classmates once again negatively affects girls' self-confidence. In classes where all applicants are admitted, and hence leave the class, girls have on average a 11% higher probability of a decline in self-confidence compared to girls in classes where no one was accepted. These results suggest that the process of allocating a part of the class to academic junior high schools affects the self-confidence of girls who did not apply in two ways: first, by the competition induced in the class because of high-stake admission exams; and later on, by an even in higher rate, the loss of classmates at the end of the school year. By contrast, boys' self-confidence does not experience any change due to their classmates' placement.

Change in GPA

Another mechanism that possibly contributes to reduced self-confidence among pupils in classes with a higher number of applicants may be the change in grades given to students between the 4th and 5th grades. For example, more demanding class environments imposed by teachers in classes with a higher number of applicants – and hence a higher number of pupils preparing for high-stakes entrance exams – may naturally cause a drop in grades of those who did not apply as they are excluded from the preparation process for these exams. Pupils usually dedicate effort and extra time to prepare for the exams, which would likely boost their grades. This change in grades may also negatively impact the self-confidence of those left behind. Alternatively, however, pupils who are disappointed that they were discouraged from applying might change their effort, and their GPA can drop. In both cases, GPA can potentially explain a part of the decline in self-confidence.

To test for this, we include in our main empirical specification the change in math grades between those years. The reference group is constituted by pupils who improved their grades from the 4th to the 5th year. The results are presented in Table 4. Although the drop in math grades between the 4th and 5th years induces a significant decline in self-confidence, controlling for this change in GPA does not diminish the effect of competition in the class. In other words, the negative effect of the number of applicants in the classroom on self-confidence is not influenced by the change in GPA, representing here a more demanding teacher policy or other unobservables leading to the drop in GPA.

Intervention of parents in the application decision

Another potential factor that could explain the role of early tracking on student self-confidence is the intervention of parents. In general, there is a lot of supportive evidence that parents play an important role in students' decision to apply. While it is somewhat obvious why parents encourage their children to apply (enhanced educational and labor market opportunities derived from placement in the best schools, and with no material application cost), it is less obvious why other parents take the opposite approach, as it may appear to be irrational. Parental education per se does not play a role in the change in self-confidence, either for boys or girls (see Table 2). Parents may not want their children to go to selective schools due to their preference for transmitting social status

Table 4. Change in the self-confidence of pupils who did not apply, controlling for change in GPA.

Self-confidence (5th grade)	(1) All	(2) Girls	(3) Boys
Number of applicants (0 as control group)			
1	−0.019	−0.034	−0.007
	(0.031)	(0.050)	(0.039)
2	−0.011	−0.062	0.045
	(0.039)	(0.054)	(0.053)
3	−0.064**	−0.092**	−0.040
	(0.032)	(0.046)	(0.038)
4	−0.038	−0.129**	0.046
	(0.040)	(0.051)	(0.043)
5	−0.072**	−0.083*	−0.065
	(0.033)	(0.046)	(0.041)
Change in math grade (controlling for better grade in the 5th grade)			
No change in math grade	−0.126***	−0.094*	−0.162***
	(0.036)	(0.053)	(0.048)
Worse math grade in the 5th grade	−0.247***	−0.228***	−0.277***
	(0.038)	(0.057)	(0.049)
Individual characteristics	Yes	Yes	Yes
Class characteristics	Yes	Yes	Yes
Other Indexes (4th grade)	Yes	Yes	Yes
N	2431	1193	1238
R^2	0.289	0.274	0.282

Note: Standard errors robust to clustering at the class level in parentheses (*$p < 0.1$, **$p < 0.05$, ***$p < 0.01$).

(parents may prefer that their children have a similar education and experiences as themselves), the cost of stress of applying and then attending demanding schools, their unwillingness or inability to invest in private preparatory courses to train pupils in the exam process, or their belief that their children are not good enough or would not succeed in selective schools.

To take the explicit intervention of parents into account for pupils who did not apply (the great majority of the panel), we created a dummy variable indicating that their parents did not want them to apply, and then interacted that variable with the number of applicants in the class. The results, reported in Table 5, indicate that parents slightly influence their children in the face of a competitive environment, particularly boys in the most competitive classrooms. For example, comparing non-applying boys in the most competitive classes (5 applicants or more), those with discouraging parents have a 13% higher probability of experiencing a decline in self-confidence than boys without this parental intervention. However, the intervention of parents seems not to cause a heterogeneous effect on girls.

Persistence of the effect

Using the same specification as in the main model in Table 2 (i.e. controlling for the number of applicants in the class, 4th grade self-confidence, other 4th grade indexes, as well as individual and class characteristics), we further test the persistence of the effect on pupilś self-confidence until the 6th grade. The persistence of the decline in self-confidence may be policy relevant, as it would reveal possibly long-term effects on academic achievement. Our approach can eliminate the possibility of only a temporary change in pupils' self-assessment. The results of the persistence effect presented in Table 6 show the negative impact of the number of applicants in the classroom on the self-confidence of those who did not apply; however, the effect is marginally insignificant. The magnitude of the effect on girls' self-confidence in the 6th grade is similar to the one in the previous grade, however due to higher standard errors again insignificant.

These results should be taken with caution, as not all 5th graders in our sample were interviewed in the 6th grade. Hence, our subsample of 6th graders may not be representative and may induce sample selection bias in the results.

Table 5. The intervention of parents in interaction with the number of applicants in the class.

Self-confidence (5th grade)	(1) All	(2) Girls	(3) Boys
Parents didn't want me apply = 1	0.045	0.061	0.020
	(0.038)	(0.057)	(0.041)
Number of applicants (0 as control group)			
1	0.019	−0.013	0.039
	(0.051)	(0.072)	(0.060)
2	0.022	−0.034	0.076
	(0.047)	(0.080)	(0.055)
3	−0.044	−0.033	−0.072
	(0.056)	(0.085)	(0.057)
4	0.015	−0.072	0.082
	(0.050)	(0.078)	(0.055)
5	−0.015	−0.040	0.006
	(0.047)	(0.073)	(0.054)
*Parents = 1 * number of applicants*			
1	−0.044	0.007	−0.080
	(0.056)	(0.073)	(0.077)
2	−0.064	−0.025	−0.091
	(0.067)	(0.100)	(0.076)
3	−0.020	−0.069	0.055
	(0.070)	(0.106)	(0.062)
4	−0.081	−0.063	−0.073
	(0.060)	(0.102)	(0.070)
5	−0.115**	−0.094	−0.126*
	(0.053)	(0.079)	(0.070)
Individual characteristics	Yes	Yes	Yes
Class characteristics	Yes	Yes	Yes
Other Indexes (4th grade)	Yes	Yes	Yes
N	2244	1101	1143
R^2	0.264	0.258	0.247

Note: Standard errors robust to clustering at the class level in parentheses (*$p < 0.1$, ** $p < 0.05$, ***$p < 0.01$).

Table 6. Persistence of the decline in self-confidence until the 6th grade.

Self-confidence (6th grade)	(1) All	(2) Girls	(3) Boys
Number of applicants (0 as control group)			
1	0.029	−0.023	0.072**
	(0.036)	(0.058)	(0.036)
2	−0.086*	−0.089	−0.083
	(0.051)	(0.055)	(0.067)
3	−0.047	−0.080	−0.016
	(0.037)	(0.053)	(0.041)
4	−0.032	−0.116	0.044
	(0.047)	(0.073)	(0.048)
5	−0.051	−0.069	−0.034
	(0.036)	(0.051)	(0.042)
Individual characteristics	Yes	Yes	Yes
Class characteristics	Yes	Yes	Yes
Other Indexes (4th grade)	Yes	Yes	Yes
N	2050	1013	1037
R^2	0.224	0.201	0.222

Note: Standard errors robust to clustering at the class level in parentheses (*$p < 0.1$, **$p < 0.05$, ***$p < 0.01$).

Conclusion

Early tracking is a feature of many educational systems around the globe, the typical aim of which is to sort pupils into homogeneous ability groups that may make it more efficient for students to learn and teachers to teach. Our goal is to not assess early tracking as such, but to examine the effect of the competitive application process inherent in early tracking systems on the self-confidence of students

who do not apply to such selective schools. Our interest in changes in self-confidence derives from the role of self-confidence as a soft skill that can potentially impact future educational and occupational attainment, as well as a form of aversion to unequal outcomes of competition. To do this, we operationalize the competitive process in terms of the number of pupils who apply, and their success rate relative to their classroom, while controlling for a variety of individual and contextual variables, including changes in GPA.

We first found that mainly girls are inequality averse, in terms of experiencing a decline in self-confidence between the beginning and the end of their exposure to competition to selective schools. When we differentiate the number of applicants from the number of successful ones, we find that girls are particularly averse to the latter, i.e. by the unequal payoffs realized in the tracking process, rather than by the number of applicants per se. Boys, by contrast, seem to be unaffected by any of these processes. We also find that the gender difference in the decline in self-confidence, as well the degree of that decline, is similar in the 5th and 6th grades, however insignificant in the latter, indicating that there could be some long-term effects of early selection on students' self-confidence, but other unobserved factors may also play a role.

We believe that these results are relevant to the academic literature in a number of ways. As research increasingly examines the role of soft and hard skills on educational and occupational attainment, it will become increasingly important to understand the role of features of educational systems in shaping key traits like self-confidence in mathematics. Second, gender gaps in the attainment of academic degrees in STEM fields, and the policy goal of increasing women's participation in those fields, suggests it is crucially important to understand why girls might become less self-confident in STEM fields during the critical years of their academic development. And lastly, as scholars continue to debate the degree of inequality and efficiency in educational systems with varying types and degrees of tracking, we show that the role of tracking on the 'socioemotional' development of children warrants scholarly attention.

The results of our analysis come with certain limitations and caveats. First, besides the grades given by teachers to students, we have little information about changes in teacher policy between the 4th and 5th grades. It is possible that changes in teacher policy, or changes in study materials, would influence students' self-confidence. That, however, would not explain why self-confidence would be so strongly influenced by the intensity of the competitive process. But if it could be shown that there are some unobserved teacher behaviors correlated to the intensity of competition, those unobservables could potentially explain some of the estimated effects we have found in this study. That would not detract from our overall findings on the impact of early tracking on self-confidence, but it would enable us to better differentiate the role of teachers during the competitive process from the competitive process itself. Further, our identification strategy has a potential weakness in our inability to control for the overall trend in self-confidence, which might be different in classes with a different number of applicants.

Our study would also benefit from additional follow-up analyses. To what degree does early tracking impact self-confidence in later adolescence, and how does that self-confidence impact latter educational aspirations and attainment? Given that we have a panel of pre-treatment pupils as well as their estimated cognitive and non-cognitive skills, the results of this study would be enriched by a closer examination of the long-term effects of early-tracking competition.

Notes

1. Bandura (1997) posited that self-confidence in one's own capacities was the result of observed performance and other social-psychological factors (Usher and Pajares 2009). The previous literature also discussed the problem of nature vs. nurture in gender differences in competitiveness (Niederle and Vesterlund 2010), but not self-confidence as such.
2. Previous evidence and our data suggest that parental background and 4th grade GPA are the main predictors of application decisions. It is therefore reasonable to assume that 11 year olds have a rather passive role in the decision to apply, and no decision to apply would be made without the support of their parents.

3. A sub-sample of the 5th graders – i.e. 2837 students – were further interviewed in subsequent school years. To examine the long-term effects of tracking, we provide also the main descriptive statistics for 6th graders.
4. Here, we refer to the loss of classmates to selective academic junior high schools. Pupils can also experience the loss of classmates e.g. when they move to a different city. Because such changes are few and heterogeneous, we do not include them in our analysis.
5. The math test score from TIMSS is normalized to a mean of 0 and a standard deviation of 1.
6. The variable for GPA is constructed as an average of final grades from mathematics, Czech language and a foreign language. In the Czech Republic, grades are distributed on a 5-point scale from 1 (the best grade) to 5 (the worst grade).

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