4 Does what teachers and schools do matter differently depending on student achievement and gender?

Providing equal educational opportunities means that all students, irrespective of their gender or background, have the same chances of fulfilling their potential. However, despite significant efforts made by societies to narrow disparities in students' outcomes in the recent past, gaps still persist. Drawing on the rich TALIS-PISA link data, this chapter explores whether certain teacher and school factors that are identified in Chapter 2 of this report as key predictors of student achievement for average performing students also matter for low achievers and their high-achieving peers. In addition, the chapter investigates the teacher and school factors that are significantly related to within-school disparities in performance between girls and boys.

Highlights

- On average across the countries and economies participating in the TALIS-PISA[1] link, certain teacher and school factors, including teachers' class time spent on actual teaching and learning, teachers' satisfaction with the work environment, teachers' working hours spent on marking and correcting, the concentration of academically gifted students in the classroom as well as the degree of parents' and community's involvement in school-related activities, matter both for low and high-achieving students.
- On average across the countries and economies participating in the TALIS-PISA link, the share of teachers reporting workload as an important source of stress at the school may matter specifically for low-performing students in relation to their performance in reading and mathematics. Teachers' workload stress is significantly associated with better performances for low-achieving students in both subject domains. This may signal teachers' commitment and dedication to their work in general. More concretely, it may hint at teachers' extra effort in helping low-achieving students, which, in turn, can lead to additional workload-induced stress.
- Girls outperform boys in reading in around one-third of the schools, on average across the countries and economies participating in the TALIS-PISA link. The opposite pattern is observed for mathematics and science, with boys performing better than girls, although in fewer schools, unlike girls' overperformance in reading. In quite a few schools in each participating country and economy, boys perform equally well or better than girls in reading and girls perform equally well or better than boys in mathematics and science. This suggests that gender gaps can be closed within schools.
- As the level of disciplinary issues that the average school teacher perceives in the classroom increases, the outperformance of girls over boys in reading in the school tends to increase on average across the countries and economies participating in the TALIS-PISA link. This signals that boys might be more affected by a deteriorated classroom climate as they tend to be exposed to greater peer pressure than girls, but also as they may be more likely to disturb classes.
- On average across the countries and economies participating in the TALIS-PISA link, girls tend to outperform boys in reading even more in those schools where principals report more often that they observe instruction in the classroom and resolve problems with the lesson timetable. On the contrary, boys' performance increases compared to that of girls when the school leader more regularly ensures that teachers feel responsible for their students' learning outcomes.
- Teacher-student relations as well as stakeholder involvement in school seem to matter for school-level gender differences in reading performance. In schools where the average school teacher considers teacher-student relationships to be positive, disparities in reading performance between girls and boys tend to decrease in favour of boys on average across countries and economies participating in the TALIS-PISA link. Similarly, in Colombia and Denmark, boys are more likely to perform as well as (if not better than) girls in reading in schools where the degree of parents' and community's involvement in school-related activities is higher.
- Teachers may have greater influence on the academic performance of students of their gender either because they apply distinct teaching practices that suit same-gender students better or because they address gender stereotypes by acting as role models for students of their gender. In Ciudad Autónoma de Buenos Aires (hereafter CABA [Argentina]), the Czech Republic and Turkey, the differences in performance in reading, mathematics and science between girls and boys tend to change in favour of girls as the share of female teachers increases in the school. In the same way, as the share of male teachers increases in the school, the better boys perform compared to girls in all subjects.

Introduction

Succeeding in today's fast-changing world requires skills rooted in academic competences such as literacy, numeracy and science but also the ability to think critically, cope with unforeseen problems, communicate effectively and work in teams. Teaching market-relevant skills to all students is more important than ever. Poor or inadequate skills limit access to better-paying and more rewarding jobs and, more generally, to better living and health conditions and higher social and political participation (Hanushek et al., 2015[1]; OECD, 2016[2]). Extensive research confirms the impact of low academic performance on future educational and socio-economic development – see, for example, Erikson et al. (2005[3]) and Rose and Betts (2004[4]).

Schools and education systems have the ambition to provide equal learning opportunities to all students. Equity does not mean that all students must obtain equal outcomes but rather that, provided with the same opportunities, differences in students' outcomes are not driven by individual factors like gender, socio-economic status, immigration background or disabilities (OECD, 2018[5]) – on the equality of opportunity theory see, for example, the influential contribution by Roemer (1998[6]). In other words, giving equal opportunities to all students means that, boys and girls, socially advantaged and socially disadvantaged students as well as native and migrant students have the same chances of fulfilling their potential. Giving equal opportunities to all students also means that the implemented teaching practices and teacher-related policies benefit as many students as possible without being detrimental to a few – either the most fragile or the most talented – and that they strike the collective optimum.

However, despite significant efforts made by societies to narrow disparities in students' outcomes in the recent past, gaps still persist (OECD, 2019[7]; OECD, 2018[5]). According to PISA results, more boys than girls score below the baseline level of proficiency in reading, mathematics and science; among high-performing students there are fewer girls than boys in areas such as mathematics, science and problem solving. Yet, even when boys and girls are equally proficient, their attitudes towards learning and aspirations are very different (OECD, 2019[7]; OECD, 2015[8]). Students' family socio-economic status is widely recognised as a reliable predictor of their academic performance and, indirectly, success in life. Analyses based on PISA data show consistently that, while many disadvantaged students succeed at school, advantaged students tend to outperform their disadvantaged peers in all subjects. Disparities in outcomes by students' immigration background have been observed in all PISA cycles. Generally, non-immigrant students outperform their first- and second-generation immigrant peers even after accounting for students' and schools' socio-economic profile (OECD, 2019[7]). Nevertheless, this association is closely related to the socio-economic background of immigrant students, and thus may not hold for countries that apply selective immigration policies favouring highly-skilled immigrants.

This chapter explores the characteristics and practices of schools and their teachers that matter for equity in student achievement. It draws on the rich TALIS-PISA link 2018 dataset of 15-year-old students, their teachers and schools from eight countries and economies[2] – Australia, CABA (Argentina), Colombia, the Czech Republic, Denmark, Georgia, Malta and Turkey. It addresses the following research questions: Do teacher and school factors matter equally for students with different academic performance? How can schools mitigate gender disparities in student performance? To address the first aforementioned research question, the chapter applies quantile regressions to explore whether the factors identified in Chapter 2 (*What do teachers and schools do that matters most for student achievement?)* as key predictors of PISA test scores for average performing students also matter for low achievers and their high-achieving peers. The first section also discusses the practices and characteristics of teachers and schools that matter specifically for students with different academic performances. The next section investigates the teacher and school factors that are significantly related to within-school disparities in performance between girls and boys. It focuses on gaps among the students within schools rather than on gaps at the country level, which are much widely analysed and commented in general. While it would have been interesting and relevant from a policy viewpoint to analyse gaps in achievement between socially advantaged students

and socially disadvantaged students[3] as well as between native and migrant students[4] within schools, it was decided not to pursue this path for technical and analytical reasons. Nevertheless, since academic achievement and socio-economic status are positively related in all countries (OECD, 2019[7]), exploring the teacher and school factors that matter specifically for low achievers can be also informative in addressing disparities between socio-economically advantaged and disadvantaged students.

The TALIS-PISA link data provides an opportunity to identify teacher and school factors that may matter for equity in student performance since it offers an internationally comparable dataset combining information on key stakeholders. Yet, The TALIS-PISA link data also present important limitations. The link between teachers and students is established at the school and not at the class level. In other words, the data do not allow matching a teacher with her or his students; rather the data only permit matching a sample of teachers teaching 15-year-old students in a school with a sample of 15-year-old students of that same school. Therefore, information on teachers is averaged at the school level to be analysed together with students' outcomes. Given that teachers of the same school differ significantly in terms of their characteristics and practices, linking data by averaging teachers' variables at the school level triggers a considerable loss of information.[5] For the analyses of gender gaps in student achievement, student performances are also averaged by gender at the school level and not at the class level. Finally yet importantly, the cross-sectional design of the survey prevents the measurement of any teacher causal effects or distinguishing between short-term and long-term effects of teachers and schools on students' outcomes.

Do teacher and school factors matter equally for students with different academic performances?

Performance at school has long-term consequences for both students and society as a whole. For example, Hanushek and Woessmann show that a small increase in students' cognitive outcomes, as measured by PISA, can have a very large impact on a nation's economic growth. According to their estimates, a 25-point rise in the average PISA score of all OECD countries has the potential of generating a GDP gain of USD 115 trillion over the lifetime of a generation (OECD, 2010[9]). Concentrating efforts on raising the academic level of lower-performing students is an effective way to improve education systems' overall performance and equity since students from disadvantaged backgrounds are over-represented among low performers (OECD, 2018[5]; OECD, 2016[10]).

Students' academic performance at school is not associated with a single student, teacher or school characteristic; rather, it results from the combination of several factors. Chapter 2 of this report describes these factors extensively as well as their direct and indirect effects on student performance by focusing on the mean of student performance distribution, i.e. the average performing student.

However, by focusing on average performing students, these findings may miss important variations in the way teacher and school factors matter for students with different competence levels. To this end, this section applies quantile regression analysis to identify if the factors identified in Chapter 2 as key predictors of PISA test scores for average performing students differ at various points in the conditional distribution of students' performances (as measured in PISA 2018 across reading, mathematics and science). In contrast with standard linear regressions that focus on the average performing student, quantile regressions can provide a more detailed picture by allowing for analysis of the effect of teacher and school factors on student performance at different achievement levels (Box 4.1).

Box 4.1. Quantile regression

While standard linear regression estimates the conditional mean of the outcome variable, given a set of explanatory variables, quantile regression provides information about the association between the outcome variable and the explanatory variables at the different percentiles in the conditional distribution of the outcome variable (Koenker, 2017[11]; Koenker, 2005[12]; Koenker and Bassett, 1978[13]).

Quantile regression can be appealing in comparison to standard linear regression (Cameron and Trivedi, 2009[14]), since:

- It provides a richer characterisation of the relationship between the outcome variable and the explanatory variables by allowing the effects of the explanatory variables to vary over different quantiles of the conditional distribution
- It is more robust in terms of outliers and assumptions about the distribution of regression errors.

However, it is important to note that quantile regression estimates tend to be more precise at the centre of the distribution as compared to upper and lower quantiles. Thus, for those relationships where the variation in the effects of the explanatory variables over the different quantiles of the conditional distribution of the outcome variable is limited, quantile regression is less likely to find significant coefficients at the tails of a distribution than at the centre.

Note: For additional information on quantile regression, see Annex B.
Sources: Cameron, A. and P. Trivedi (2009[14]), *Microeconometrics Using Stata*; Koenker, R. (2017[11]), "Quantile regression: 40 years on", *Annual Review of Economics*, http://dx.doi.org/10.1146/annurev-economics-063016-103651; Koenker, R. (2005[12]), *Quantile Regression*, http://dx.doi.org/10.1017/CBO9780511754098; Koenker, R. and G. Bassett (1978[13]), "Regression quantiles", *Econometrica: The Journal of the Econometric Society*, http://dx.doi.org/10.2307/1913643.

Quantile regression analysis had not been applied on TALIS data or on TALIS-PISA link data before this report. Yet, various studies have estimated quantile regressions using PISA data, shedding light on more nuanced findings. A few studies focused on the varying relationship of school composition with student performance. For example, Rangvid (2007[15]) combined PISA 2000 data with administrative data from Denmark to estimate the relationships between school socio-economic composition and students' test scores. This study finds that low-achieving students benefit more from socially advantaged peers than high-achieving students do in reading performance but not in mathematics and science.[6] Also, Raitano and Vona (2013[16]) studied the interaction between school-tracking policies and peer effects. Exploiting PISA 2006 data, they concluded that peer heterogeneity in terms of ability reduces students' performances in the comprehensive system while it increases student performance in the early-tracking system. In addition, they also found evidence for stronger peer effects for low-ability students.

A few other studies looked at the varying relations between teacher or school practices and student performance. Using PISA 2015 data, Mostafa et al. (2018[17]) examined – among others – whether the relationship between science proficiency and teaching practices vary at different points in the distribution of students' science test scores. According to their findings, enquiry-based science and teaching practices and teacher-directed science instruction appear to matter as much for low performers as for top performers (i.e. students in the bottom decile and in the top decile of the science test score distribution) in all or almost all of the PISA countries and economies with available data. Drawing on PISA 2012 data, Teng (2020[18]) explored the effects of school climate on disparities in students' mathematics achievement in Shanghai (China) and concluded that school climate matters more in low and average-performing schools, and for underachievers and medium-level students. In an article based on PISA 2009 data for Thailand, Lounkaew (2013[19]) analysed the gap between students in urban and rural areas. Their results pointed to the importance of unobservable school characteristics beyond the student and school characteristics

measured by PISA in explaining achievement gaps between these students. Decomposition exercises by level of achievement revealed the increasing role of these unobserved characteristics: the higher students' achievement levels are, the greater the role these characteristics play in explaining the achievement gap between urban and rural areas.

All in all, findings from past studies that applied quantile regressions on PISA data indicate that certain school contexts and practices may have differential effects on students, depending on their achievement level. This kind of analyses can reveal policy levers that would address the needs of targeted groups of students such as low achievers. They also identify teacher and school practices that are actually effective for all students, regardless of their ability level.

This section applies quantile regressions on the TALIS-PISA link dataset to investigate whether the effects of teacher and school factors differ along the distribution of students' test scores. Chapter 2 of this report concludes that factors such as teachers' classroom practices (in particular the share of class time spent on actual teaching and learning), classmates' characteristics (in particular the share of socio-economically disadvantaged students and the concentration of academically gifted students in the school), teachers' well-being and job satisfaction (in particular workload stress and satisfaction with the work environment), teachers' use of working hours (in particular the hours spent on marking and correcting student work) and school culture (in particular, stakeholders' involvement in school activities) are key predictors of students' PISA test scores in reading, mathematics and science. By estimating quantile regressions at the 25th and 75th percentiles in the conditional distribution of students' performances in reading, mathematics and science, this section examines whether the aforementioned factors also matter for low achievers and their high-achieving peers. It also explores whether there are practices and characteristics of teachers and schools that matter specifically for low-performing students or their high-performing peers.[7]

For ease of reading in the following sections, students at the 25th percentile (or equivalently at the bottom quartile) of the test score distribution are referred to as low achievers (or in equivalent terms as low performers, low-achieving students, etc.). Students at the 75th percentile (or at the top quartile) of the test score distribution are referred to as high achievers. In the following sections, the interpretation of the quantile regression results focuses on the significance and to a lesser extent on the size of the regression coefficients estimated at the bottom and the top quartiles of the conditional performance distribution. For example, a teacher factor will be deemed more important for low achievers than for high achievers if it is found to be significant (and generally greater in absolute value) for the bottom quartile but not for the top quartile. The reported analyses are likely to be conservative to the extent that an association between certain teacher and school factors and outcomes of low- or high-achieving students might not be significant due to less precision at the tails of the distribution (Box 4.1) even though these factors might truly contribute to the academic performance of low or high achievers. Differences in the coefficients between quartiles are neither reported nor commented on as in most cases they are not significant. Therefore, great caution must be taken while interpreting these findings.

Teachers' classroom practices

The teacher dimension of classroom practices is consistently highlighted in Chapter 2 as well as by education research as an important predictor of student performance (Hattie, 2009[20]; Le Donné, Fraser and Bousquet, 2016[21]; Muijs et al., 2014[22]). The more class time the average school teacher spends on actual teaching and learning, the better students tend to perform on average in all three subjects covered by PISA (i.e. reading, mathematics and science) in the Czech Republic, Turkey and on average across the countries and economies participating in the TALIS-PISA link (Tables 2.5, 2.9 and 2.13). In Denmark, there is a positive relationship for mathematics and science, but the association is not statistically significant for reading.

Results of quantile regression analysis (focusing on the 25th and 75th percentiles of the conditional distribution of students' performance in PISA tests) indicate that the share of class time spent on actual

teaching and learning matters as much for low performers as for top performers on average across the countries and economies participating in the TALIS-PISA link and in Turkey (Figure 4.1). In the case of the Czech Republic, the positive relationship between teachers' time spent on actual teaching and learning and student performance seems to hold only for low-performing students. This suggests that only low performers benefit from additional teaching and learning time in the Czech Republic.

Research on the relationship between learning time and student achievement offers mixed evidence. Patall, Cooper and Allen (2010[23]) conducted a comprehensive search of the literature on this topic and found 15 studies conducted between 1985 and 2009. The literature revealed, first, that survey designs are generally weak for making causal inferences. The TALIS-PISA link design is no exception to this. That said, findings from the literature suggest that extending school time can be an effective way to support student learning, particularly for students most at risk of school failure and when considerations are made for how time is used. Moreover, the strongest research designs produced the most consistent positive results. Here, it must be kept in mind that what the TALIS-PISA link measures is the share of typical lessons spent on actual learning and teaching and not the actual amount of time spent on learning by students. Findings suggest that such quality class time is beneficial to all students, regardless of their ability level. This suggests that teachers should spend as much as possible of their class time on teaching and learning rather than on administrative tasks and classroom management. The exception found in the Czech Republic is consistent with past research finding that additional learning time is especially important for slower learners and low-performing students (Gromada and Shewbridge, 2016[24]).

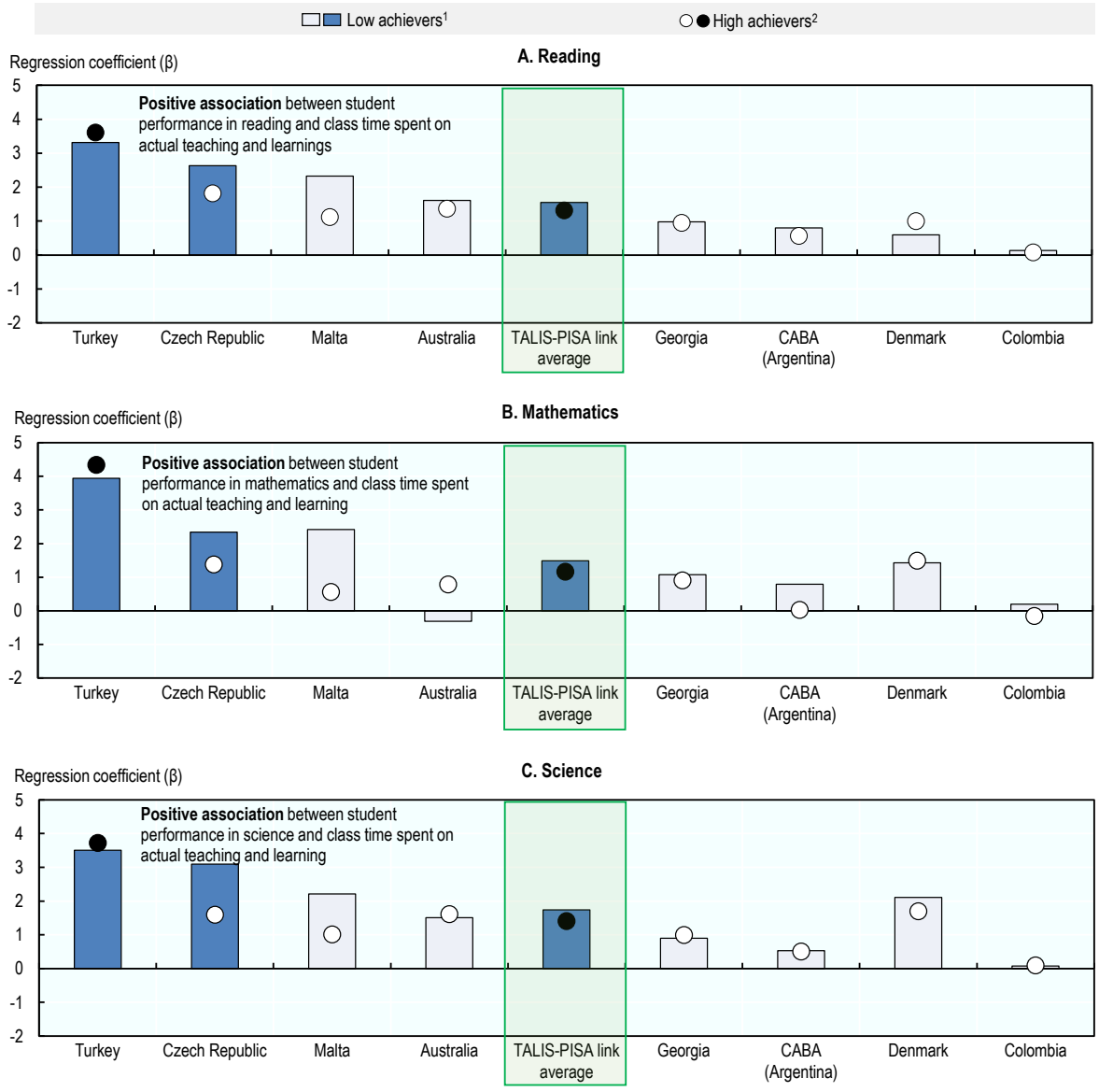
In the case of Denmark, however, the association between the share of class time spent on actual teaching and learning, and student performance is no longer significant when moving away from average performing students and focusing on low and high achievers (Figure 4.1). This suggests that teachers, deliberately or not, tailor their teaching practice and use of time to address the needs of average students. However, this finding may be due to a statistical artefact of quantile regression analysis as estimates tend to be more precise at the centre of the distribution as compared to upper and lower quantiles (Box 4.1).

Teachers' well-being and job satisfaction

In line with previous research findings, which indicate that teachers' satisfaction with their job can have an indirect positive effect on student achievement through teachers' beliefs, attitudes and practices as well as school culture (Ainley and Carstens, 2018[25]), teachers' well-being and job satisfaction is a dimension that is found to matter for student performance in Chapter 2. The more teachers are satisfied with the work environment on average at the school, the better students tend to perform in all three subjects covered by PISA in Australia, the Czech Republic, Georgia, Turkey and on average across participating countries and economies (Tables 2.25, 2.29 and 2.33).

Figure 4.1. Conditional relationship between class time spent on teaching and student achievement

Change in PISA score associated with average class time spent on actual teaching and learning at the school, conditional on student PISA score, by subject



1. Low-achieving students are those at the bottom quartile (i.e. 25th percentile) of the conditional distribution of PISA score.
2. High-achieving students are those at the top quartile (i.e. 75th percentile) of the conditional distribution of PISA score.

Notes: Results of quantile regression based on responses of 15-year-old students and teachers. Controlling for the following classroom practices of teachers: teachers' autonomy over planning and teaching, perceived disciplinary climate, use of practices related to clarity of instruction, use of practices related to cognitive activation, use of assessment practices, such as administering own assessment, providing written feedback on student work in addition to marking, letting students evaluate their own progress and observing students when working on particular tasks and providing immediate feedback; and for the following student characteristics: gender, immigrant background and index of economic, social and cultural status. Teacher variables are averaged for all teachers within the school. The TALIS-PISA link average corresponds to the arithmetic mean of the estimates of participating countries and economies, excluding Viet Nam.

Statistically significant coefficients are marked in a darker tone (see Annex B).

Countries and economies are ranked in descending order of the change in low achievers' PISA score in reading associated with the average class time spent on actual teaching and learning at the school.

Sources: OECD, TALIS 2018 Database; OECD, PISA 2018 Database, Tables 4.1, 4.2, 4.3, 4.4, 4.5 and 4.6.

StatLink https://doi.org/10.1787/888934224030

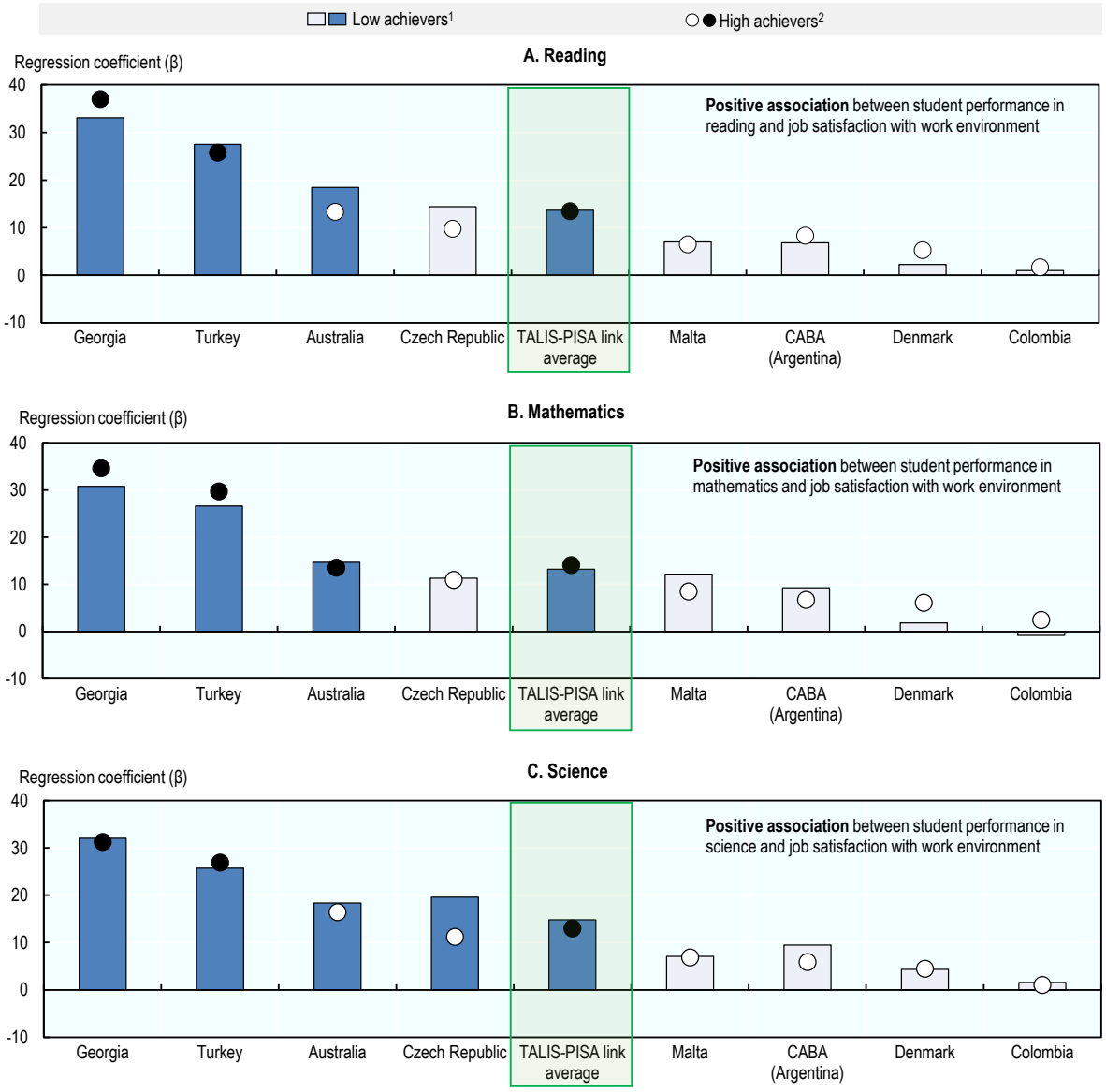
Quantile regression analysis indicates that, regardless of the subject, teachers' satisfaction with the work environment is positively associated with student performance for both low- and high-performing students on average across participating countries and economies, and in Georgia and Turkey (Figure 4.2). The same result holds in the case of Australia, but only for mathematics. In Australia, the relationship between teachers' satisfaction with work environment and student performance seems to matter more for low achievers when it comes to reading and science. In the case of the Czech Republic, the association is significant only when focusing on low performers in science. The results found for Australia and the Czech Republic may signal that teachers' job satisfaction matters more for low performers than for their high-achieving peers. Teachers who are satisfied with their work environment tend to report higher self-efficacy (OECD, 2020[26]; OECD, 2014[27]), while job satisfaction also plays an important role in teachers' attitudes and efforts (Ainley and Carstens, 2018[25]). Thus, teachers' satisfaction with their work environment may be especially beneficial for low performers through teachers' increased self-efficacy and commitment.

Besides teachers' satisfaction with the work environment, the extent to which workload is an important source of stress is also an important predictor of student achievement. In Colombia, the Czech Republic, Denmark and on average across participating countries and economies, students who attend schools where teachers, on average, report workload (including lesson preparation, number of lessons to teach, marking, administrative work and extra duties due to absent teachers) as an important source of stress, tend to perform better in all three subjects covered by PISA (Tables 2.25, 2.29 and 2.33). This may signal teachers' commitment and dedication to their work as well as point to a reverse causal relationship as highly competitive school environments (attended by higher- performing students) can lead to workload being an important source of stress for teachers.

Quantile regressions results show that the positive association between workload being an important stress for teachers and student performance holds for both low and top performers in the Czech Republic for all three subjects covered by PISA, only for mathematics in Colombia, only for reading in Denmark and only for science on average across participating countries and economies (Figure 4.3). In Colombia, workload-induced stress seems to matter more for high-achieving students in reading and science. This may hint at the presence of highly competitive school environments that can lead to additional workload-induced stress for teachers. On the contrary, in the case of Denmark, the relationship seems to be more prominent for low performers in mathematics and science, which may signal teachers' commitment and dedication to their work in general. More concretely, it may hint at the extra effort teachers make in helping low-achieving students, which, in turn, can lead to additional workload-induced stress. Similarly, workload-induced stress seems to be more closely related to student achievement for low-performing students in reading and mathematics on average across participating countries and economies.

Figure 4.2. Conditional relationship between teachers' satisfaction with work environment and student achievement

Change in PISA score associated with the average job satisfaction with work environment at the school, conditional on student PISA score, by subject



1. Low-achieving students are those at the bottom quartile (i.e. 25th percentile) of the conditional distribution of PISA score.
2. High-achieving students are those at the top quartile (i.e. 75th percentile) of the conditional distribution of PISA score.

Notes: Results of quantile regression based on responses of 15-year-old students and teachers. Controlling for the following aspects of well-being and job satisfaction: workplace well-being and stress, workload stress, job satisfaction with profession, teachers' satisfaction with the salary, teachers' satisfaction with the terms of the teaching contract apart from salary (e.g. benefits, work schedule), teachers' views of the way different stakeholders value the profession; and for the following student characteristics: gender, immigrant background and index of economic, social and cultural status. Teacher variables are averaged for all teachers within the school. The TALIS-PISA link average corresponds to the arithmetic mean of the estimates of participating countries and economies, excluding Viet Nam.

Statistically significant coefficients are marked in a darker tone (see Annex B).

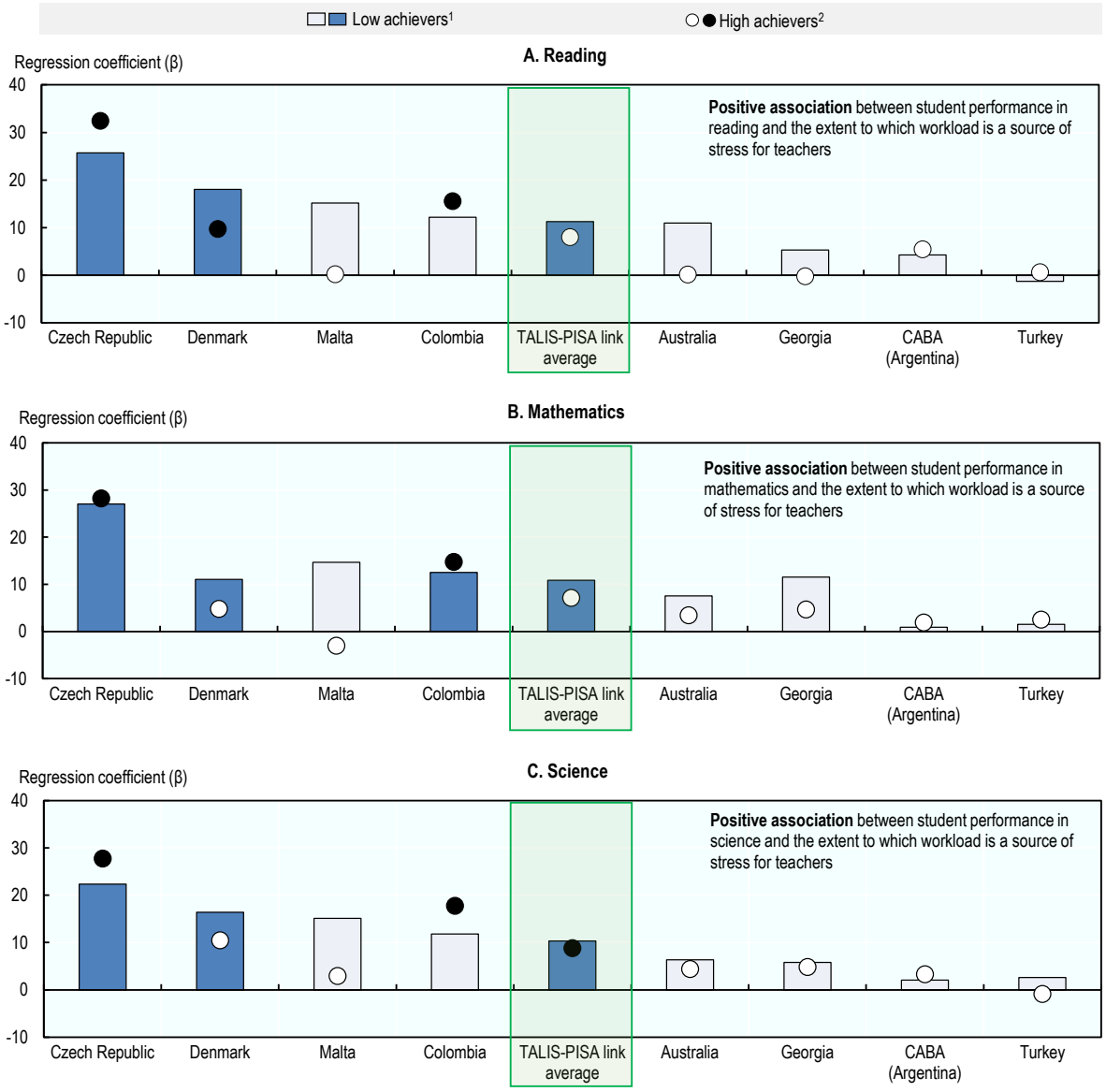
Countries and economies are ranked in descending order of the change in low achievers' PISA score in reading associated with the average job satisfaction with work environment.

Sources: OECD, TALIS 2018 Database; OECD, PISA 2018 Database, Tables 4.7, 4.8, 4.9, 4.10, 4.11 and 4.12.

StatLink https://doi.org/10.1787/888934224049

Figure 4.3. Conditional relationship between teachers' workload-induced stress and student achievement

Change in PISA score associated with the average extent to which workload is a source of stress for teachers at the school, conditional on student PISA score, by subject



1. Low-achieving students are those at the bottom quartile (i.e. 25th percentile) of the conditional distribution of PISA score.
2. High-achieving students are those at the top quartile (i.e. 75th percentile) of the conditional distribution of PISA score.

Notes: Results of quantile regression based on responses of 15-year-old students and teachers. Controlling for the following aspects of well-being and job satisfaction: workplace well-being and stress, job satisfaction with the work environment, job satisfaction with profession, teachers' satisfaction with the salary, teachers' satisfaction with the terms of the teaching contract apart from salary (e.g. benefits, work schedule), teachers' views of the way different stakeholders value the profession; and for the following student characteristics: gender, immigrant background and index of economic, social and cultural status. Teacher variables are averaged for all teachers within the school. The TALIS-PISA link average corresponds to the arithmetic mean of the estimates of participating countries and economies, excluding Viet Nam.

Statistically significant coefficients are marked in a darker tone (see Annex B).

Countries and economies are ranked in descending order of the change in low achievers' PISA score in reading associated with the average extent to which workload is a source of stress for teachers at the school.

Sources: OECD, TALIS 2018 Database; OECD, PISA 2018 Database, Tables 4.7, 4.8, 4.9, 4.10, 4.11 and 4.12.

StatLink https://doi.org/10.1787/888934224068

Teachers' use of working time

The way teachers balance their time among the often competing tasks is important for the quality of the teaching and student learning (OECD, 2019[28]). While research highlights the positive implications of formative assessment in the form of constructive and immediate feedback for teaching and learning (Muijs and Reynolds, 2001[29]), summative assessment of students' work in the form of tests and exams also provides feedback to students about their learning progress (Ainley and Carstens, 2018[25]). In addition, teachers' time spent on summative assessment can be indicative of teachers' engagement in formative assessment. According to the results of multiple linear regressions in Chapter 2, the more working hours teachers spend on marking and correcting, the better students tend to perform on average at the school in all three subjects covered by PISA in Australia, Colombia, the Czech Republic, Georgia and on average across participating countries and economies (Tables 2.37, 2.41 and 2.45).

The positive relationship between teachers' working time spent on marking and correcting student work, and student performance observed for the average performing student seems to matter as much for low performers as for top performers, irrespective of the subject, in Colombia, the Czech Republic, Georgia and on average across participating countries and economies (Tables 4.13, 4.14, 4.15, 4.16, 4.17 and 4.18). This is also true for Australia, but only for reading. In Australia, teachers' working time spent on marking and correcting seems to matter especially for low achievers in mathematics and science, and not significantly for their high-achieving peers.

Classmates' characteristics

Chapter 2 of this report suggests the presence of peer effects. TALIS-PISA link data show that as the average concentration of students from socio-economically disadvantaged homes in the classrooms increases, the worse students tend to perform academically in several countries and economies participating in the TALIS-PISA link, including Australia, Colombia and Georgia (Tables 2.49, 2.51 and 2.53). This relationship also becomes significant for the TALIS-PISA link average for all three subjects as the focus shifts exclusively to subject teachers (Tables 2.50, 2.52 and 2.54). Indeed, a student's performance can be negatively affected if surrounded by classmates with limited social, economic and cultural resources. This may also reflect an overall concentration of important disadvantages in the student's local community. As socio-economic disadvantage often translates into lower achievement, being surrounded by classmates from socio-economically disadvantaged homes tends to go hand-in-hand with having academically struggling classmates. Past research shows that struggling classmates can be detrimental to student performance due to reduced teaching time and altered teaching strategies (OECD, 2019[7]; Sacerdote, 2011[30]). Yet, former research findings also suggest that sorting students by their ability may widen disparities in performance since high-performing students tend to be less affected than their low-achieving peers by the composition of their classes (Burke and Sass, 2013[31]; Lavy, Silva and Weinhardt, 2012[32]; Sacerdote, 2011[30]).

Quantile regression results indicate that the average share of students from socially disadvantaged homes in the classroom is negatively related to performance of both low- and high-performing students in Colombia (Figure 4.4). In Australia, the concentration of disadvantage appears to matter specifically for low-achieving students in mathematics performance. This finding is in line with the research consensus that suggests that low achievers may be more sensitive to the composition of their classes compared to their high-performing peers (Burke and Sass, 2013[31]; Lavy, Silva and Weinhardt, 2012[32]; Sacerdote, 2011[30]). By contrast, classmates' characteristics seem to matter only for high-achieving students in Georgia, irrespective of the subject, and in Turkey in the case of science. In the remaining countries and economies participating in the TALIS-PISA link, there is no significant relationship found between the share of socio-economically disadvantaged students and student performance, neither for low achievers nor for their high-achieving peers. This may be an artefact of focusing on the lower and upper quartiles in the distribution of student performance as opposed to the average performing student since quantile regression analysis is less likely to find significant results for the extremes of a distribution than its centre (Box 4.1). Moreover, as stated by van Ewijk and Sleegers (2011[33]), the effect of peers' socio-economic status on student achievement is highly dependent on how the socio-economic composition of a school or a classroom is defined.

The share of academically gifted students in the classroom also matters for student achievement. The greater the average concentration of academically gifted students in the classroom, the better students

tend to perform in all subjects covered by PISA in Australia, CABA (Argentina), the Czech Republic, Turkey and on average across participating countries and economies (Tables 2.49, 2.51 and 2.53). The only country where the association between the average concentration of academically gifted students in the classrooms and student achievement is not significant for any of the subject domains is Colombia. These results signal the presence of academic segregation but they can also point to the potential presence of peer effects. A student's performance can be positively affected by classmates with higher innate ability through an increase in motivation, competition and career aspirations (OECD, 2020[26]; Sacerdote, 2011[30]).

Quantile regression results show that the average concentration of academically gifted students in the classrooms matters, irrespective of the subject, as much for low performers as top performers in CABA (Argentina), the Czech Republic, Turkey and on average across countries and economies participating in the TALIS-PISA link (Tables 4.19, 4.20, 4.21, 4.22, 4.23 and 4.24). This is also true for Australia, but only for mathematics and science. In Denmark, the concentration of students with innate ability appears to matter specifically for high-achieving students in mathematics, and is insignificant in reading and science.

School culture

The dimension of school culture is highlighted by former research as well as findings in Chapter 2 as being closely related to student performance (Ainley and Carstens, 2018[25]). Students who attend schools where stakeholders (i.e. parents and community) are involved in school-related activities tend to perform better in the PISA test across all subjects in Australia, Colombia, Denmark and on average across participating countries and economies (Tables 2.55, 2.59 and 2.63). These findings are in line with past research that shows a positive association between parental and community involvement, and student achievement (Wang and Degol, 2016[34]; Wilder, 2014[35]).

Quantile regression results indicate that, on average across participating countries and economies and in Denmark, the positive association between stakeholder involvement in school-related activities and student performance holds both for low and top performers in all three subjects covered by PISA (Figure 4.5). In Colombia, the same relationship is observed for reading and mathematics. However, when it comes to performance in science, stakeholder involvement seems to matter specifically for high achievers. In Australia, the positive association only holds for reading. In the case of mathematics, high-achieving students are the ones who seem to benefit from the involvement of parents and the local community while the relationship between stakeholder involvement and student performance in science is significant neither for low-achieving students nor for their high-achieving peers.

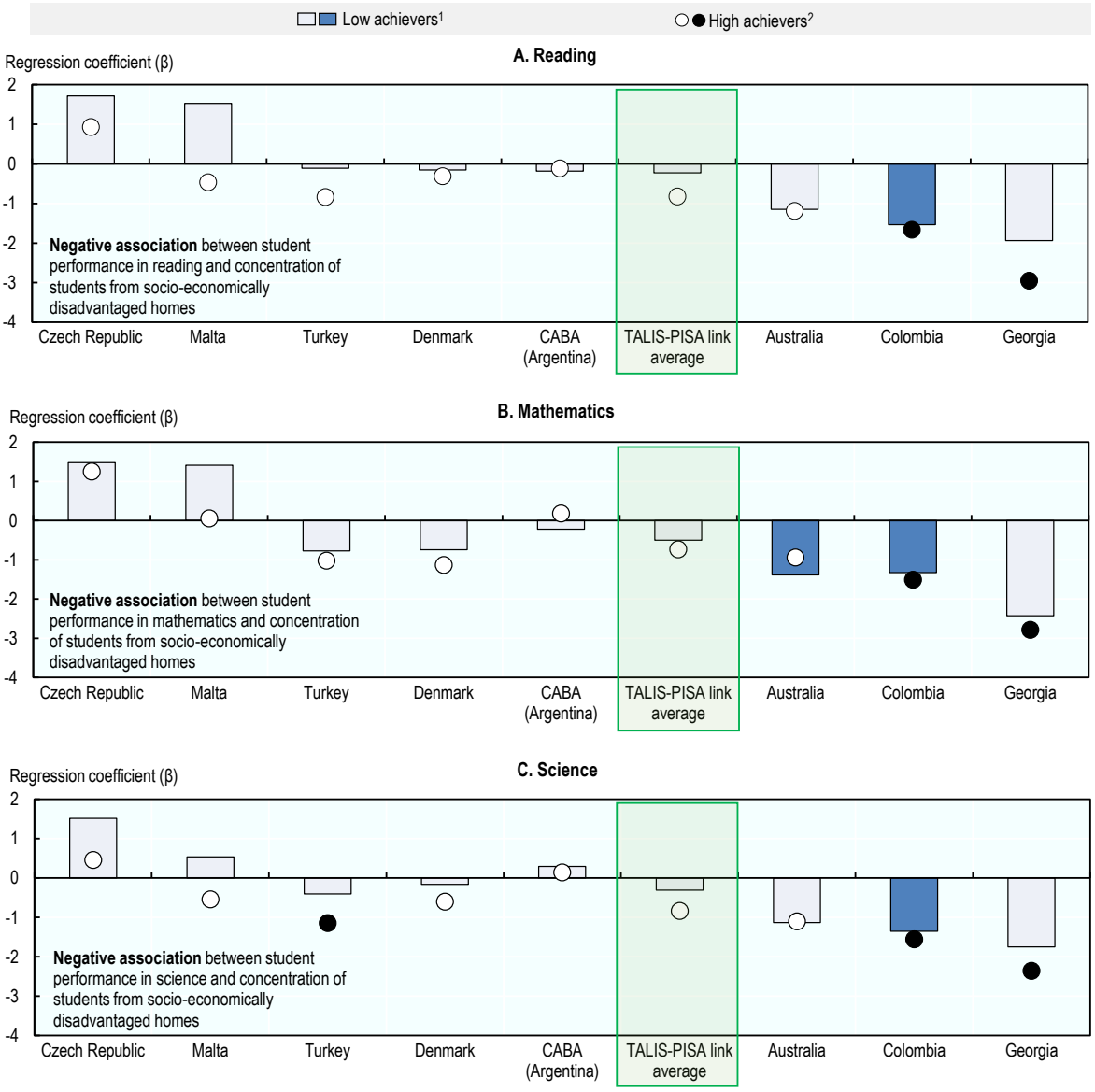
Summary

Results presented above show that teacher and school factors that matter for average students' performances in reading, mathematics and sciences also tend to matter for both low and high-achieving students on average across the countries and economies participating in the TALIS-PISA link. Teacher factors include the share of class time that teachers report spending on actual teaching and learning, the working hours teachers report devoting to correcting and marking their student work, and teachers' satisfaction with the work environment. In addition, the average concentration of academically gifted students in the classroom as well as the degree of parents' and the community's involvement in school-related activities also matter for all students, regardless of their performance level. This suggests that all these practices and characteristics could be leveraged to equally support student academic growth, regardless of their initial competence level.

One teacher factor is found to matter specifically for low-achieving students: workload-induced stress. The share of teachers reporting workload as an important source of stress at the school is positively associated with better performances for low-achieving students in two out of the three subject domains (reading and mathematics). This may signal teachers' commitment and dedication to their work in general. More concretely, it may hint at the extra effort teachers put in helping low-achieving students, which, in turn, can lead to additional workload-induced stress. While stress can be a potent force and reflect a feeling of commitment and dedication, it can also develop into burnout. Thus, workload-induced stress may signal the need for support for committed and dedicated teachers who feel overwhelmed with the workload.

Figure 4.4. Conditional relationship between concentration of students from socio-economically disadvantaged homes and student achievement

Change in PISA score associated with the average concentration of students from socio-economically disadvantaged homes at the school, conditional on student PISA score, by subject



1. Low-achieving students are those at the bottom quartile (i.e. 25th percentile) of the conditional distribution of PISA score.
2. High-achieving students are those at the top quartile (i.e. 75th percentile) of the conditional distribution of PISA score.

Notes: Results of quantile regression based on responses of 15-year-old students and teachers. Controlling for the following classroom characteristics: class size, share of students whose first language is different from the language(s) of instruction, low academic achievers, students with special needs, students with behavioural problems, academically gifted students, students who are immigrants or with a migrant background and students who are refugees; and for the following student characteristics: gender, immigrant background and index of economic, social and cultural status. Teacher variables are averaged for all teachers within the school. The TALIS-PISA link average corresponds to the arithmetic mean of the estimates of participating countries and economies, excluding Viet Nam.

Statistically significant coefficients are marked in a darker tone (see Annex B).

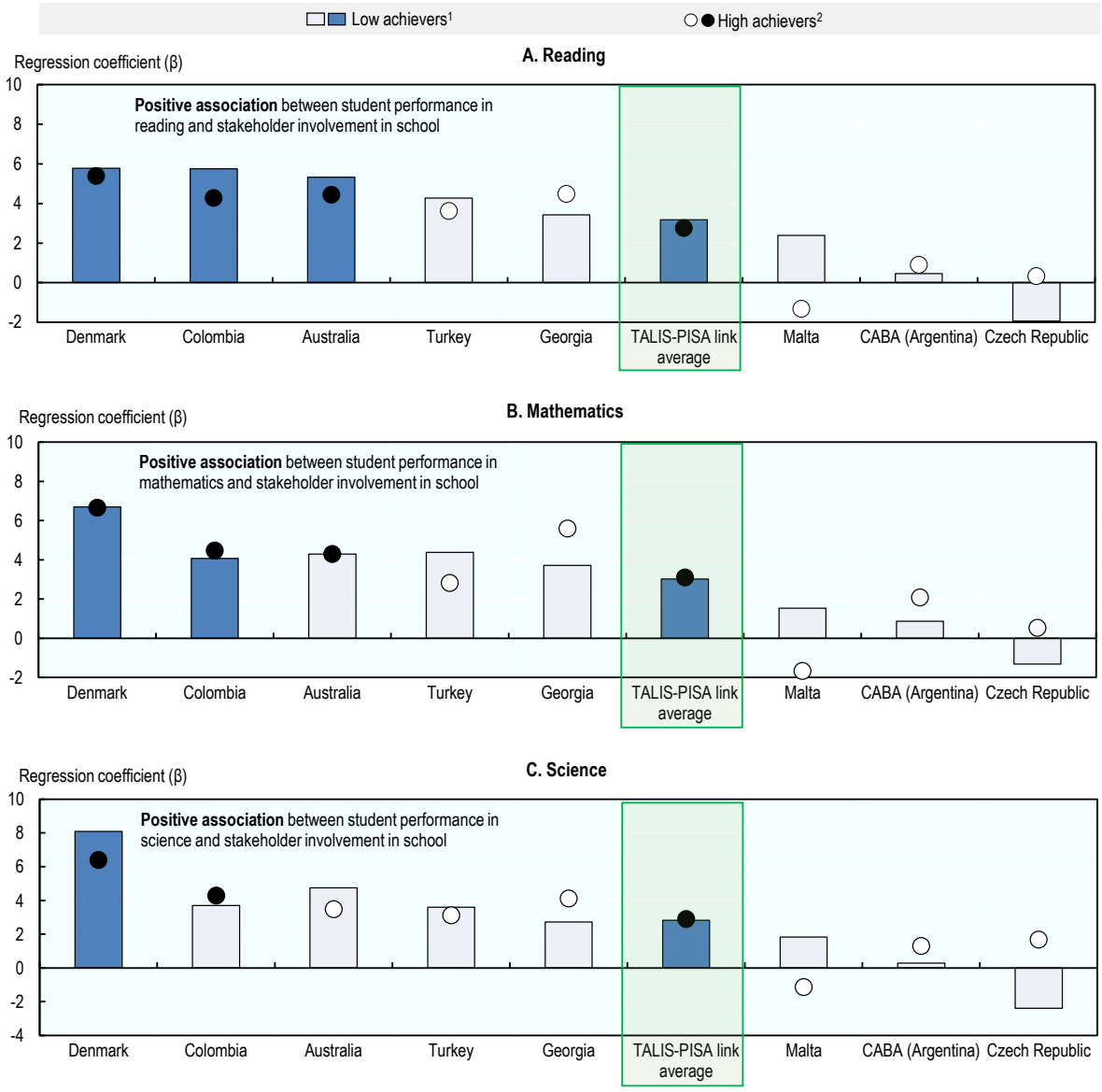
Countries and economies are ranked in descending order of the change in low achievers' PISA score in reading associated with the average concentration of students from socio-economically disadvantaged homes at the school.

Sources: OECD, TALIS 2018 Database; OECD, PISA 2018 Database, Tables 4.19, 4.20, 4.21, 4.22, 4.23 and 4.24.

StatLink https://doi.org/10.1787/888934224087

Figure 4.5. Conditional relationship between stakeholder involvement in school and student achievement

Change in PISA score associated with stakeholder (i.e. parents and local community) involvement in school, conditional on student PISA score, by subject



1. Low-achieving students are those at the bottom quartile (i.e. 25th percentile) of the conditional distribution of PISA score.
2. High-achieving students are those at the top quartile (i.e. 75th percentile) of the conditional distribution of PISA score.

Notes: Results of quantile regression based on responses of 15-year-old students, teachers and principals. Controlling for the following aspects of school culture: collaborative school culture, teacher-student relations and teachers' actions towards achieving academic excellence; and for the following student characteristics: gender, immigrant background and index of economic, social and cultural status. Teacher variables are averaged for all teachers within the school. The TALIS-PISA link average corresponds to the arithmetic mean of the estimates of participating countries and economies, excluding Viet Nam.

Statistically significant coefficients are marked in a darker tone (see Annex B).

Countries and economies are ranked in descending order of the change in low achievers' PISA score in reading associated with stakeholder involvement in school.

Sources: OECD, TALIS 2018 Database; OECD, PISA 2018 Database, Tables 4.25, 4.26, 4.27, 4.28, 4.29 and 4.30.

StatLink https://doi.org/10.1787/888934224106

How can schools mitigate gender disparities in student performance?

Gender disparities often have long-term consequences on students' fulfilment of their personal and professional potential (OECD, 2019[7]; UNESCO, 2018[36]). Mitigating these disparities in students' outcomes is high in the education policy agenda. PISA has consistently found that girls outperform boys in reading and, although to a lesser extent, that boys outscore girls in mathematics (OECD, 2019[7]). Boys tend to be overrepresented among students who lag behind and lack basic proficiency in reading that is necessary to meet the challenges of today's knowledge societies (OECD, 2019[7]). On the other hand, girls are usually not among top performers in science and mathematics, which, in turn, partly explains the underrepresentation of women in careers in science, technology, engineering and mathematics (STEM) fields (OECD, 2019[7]).

There is a growing body of evidence that concludes that school composition, school learning environment and some teacher practices are associated with gender gaps in performance. In particular, it seems that the school learning environment is related to the underperformance of boys in reading, and that girls in same-sex schools may perform better in mathematics and be more willing to take risks in their school work (OECD, 2015[8]). The social and economic resources that schools and families can provide for children's cognitive development appear to affect boys and girls differently. Boys from disadvantaged families have lower achievement scores and are less likely to complete high school than girls from a similar socio-economic background (Autor et al., 2016[37]; Brenøe and Lundberg, 2018[38]; DiPrete and Buchmann, 2013[39]). When it comes to teaching practices, PISA results suggest that teachers' use of cognitive-activation strategies in mathematics courses as well as teachers' use of strategies aimed at stimulating their students' enjoyment of reading are more effective among girls than among boys (OECD, 2015[8]).

Socialisation may also play a role in widening or bridging the gap in performances at school between girls and boys. Disparities in learning outcomes may be the result of how parents and teachers interact with boys and girls, which can be different. For instance, teachers may hold certain beliefs about boys' and girls' interests and abilities that may bias their own evaluations of student performance, which, in turn, may strengthen, or attenuate, gender gaps in achievement (Hadjar et al., 2014[40]; Robinson-Cimpian et al., 2014[41]). There is also some evidence that gender gaps in mathematics are smaller in cultures with weaker gender stereotypes (Else-Quest, Hyde and Linn, 2010[42]; Guiso et al., 2008[43]; Nollenberger, Rodríguez-Planas and Sevilla, 2016[44]; Nosek, Banaji and Greenwald, 2002[45]).

Research literature also suggests that teachers' gender can influence student performance. One broad set of explanations involves what is sometimes referred to as "passive" teacher effects. These effects are triggered by a teacher's gender identity, not by explicit teacher behaviour (Dee, 2005[46]). The most common example is the role-model effect, which operates when the presence of a teacher raises the interest and performance of students of a given gender in comparison to the other gender. For example, research was conducted on students in the US Air Force Academy, who were randomly assigned to a female professor in mandatory introductory mathematics and science courses (Carrell, Page and West, 2010[47]). The results suggest that although having a female professor has little impact on male students, it has a powerful effect on female students' performance in mathematics and science, and high-performing female students' decision to continue studying these subjects in the future. Another large-scale experiment conducted in the Paris area in France showed that a brief classroom intervention with female engineers can significantly reduce gender gaps in performance and the prevalence of stereotypical views on jobs in science (Breda et al., 2020[48]).

A second set of explanations points to "active" teacher effects, that is, biases – whether deliberate or unintended – in their prior expectations of and interactions with students who are boys or girls (Dee, 2005[46]). For instance, a study that randomly assigned teachers and students to classes in primary schools in Tel-Aviv, Israel, found that a teacher with a greater bias[8] in favour of girls (boys) has positive effects on girls' (boys') performances (Lavy and Sand, 2018[49]). More specifically, even while controlling for students'

behaviour and work ethics, as well as for past and current test scores, research suggests that teachers tend to underrate girls' mathematics proficiency. This, in turn, accounts for a substantial share of the mathematics achievement gap between equally performing and behaving boys and girls (Cimpian et al., 2016[50]; Robinson-Cimpian et al., 2014[41]).

In addition, some observational studies indicate that peer influence operates differently among boys and among girls, and that boys are exposed to greater peer pressure to conform to gender identities than girls (OECD, 2015[8]). For boys, gender identity is marked by a relative lack of interest in school in general, and in reading in particular; on the other hand, gender identity appears to have a substantial negative impact on girls' interest in mathematics (OECD, 2015[8]). Gender stereotypes seem to affect students' self-confidence and, through this channel, gaps in performances (Carlana, 2019[51]). Research also suggests that girls' low self-belief in their abilities remains, even if they perform equally well, or better, than boys (Parker, Van Zanden and Parker, 2018[52]).

Drawing on TALIS-PISA link data, this section explores the teacher and school factors that could play a role in mitigating within-school disparities in performance between girls and boys. As in Chapters 2 and 3, this section uses a supervised statistical learning method, lasso, to investigate the relationship between teacher and school factors, and within-school disparities in student outcomes (see Box 2.1 for more information). It builds on the same list of potential predictors (almost 150 predictors across 18 teacher and school dimensions) to explain the school-level differences between girls and boys. Moreover, lasso regression results are complemented with a country-level analysis that aims to identify the relative importance of each teacher and school dimension in relation to within-school disparities. To this end, multiple regression analysis featuring teacher and school dimension separately is applied to establish the teacher and school dimensions that explain the highest shares of variance in within-school disparities.

School-level differences in performance between girls and boys are regressed on indicators of each teacher and school dimension (taken separately) that is either flagged by lasso regressions as an important predictor or explains a non-negligible part of variance in within-school disparities in student performance (i.e. 20% or above on average across countries and economies). In the context of this chapter, multiple linear regressions are estimated on one dimension at a time and provide insights into how the value of within-school differences in student performance changes when any one of the independent variables within a dimension varies while all other independent variables included in the model are held constant. In comparison to lasso regressions, multiple linear regressions provide the confidence intervals of the coefficient estimates, which, in turn, allow for drawing inferences about the overall population. Moreover, they also lead to more accurate coefficient estimates through the introduction of final and balanced repeated replicate weights and the use of plausible values of student performance. In contrast to the lasso regressions, which are based on the overall population of students, teachers and principals surveyed within the TALIS-PISA link, multiple linear regressions are applied at the country level and, as a result, allow for establishing cross-country patterns.

In order to examine the teacher and school factors that matter for within-school disparities in performance by students' gender, the analyses within this section are conducted at the school level. To this end, TALIS and PISA data are linked by merging student data averaged at the school level, which are collected by PISA, with teacher data averaged at the school level and principal data, which are collected by TALIS. As student data are averaged at the school level, controls only include school-level average student characteristics but not the average school-level classroom composition. Moreover, as the analyses are conducted at the school level rather than at the student level, as in Chapters 2 and 3 of this report, sample sizes decrease considerably. This is a limitation in so far as the identification of statistically significant relationships between teacher and school factors, and within-school disparities in student outcomes is more challenging compared to student-level analysis.

The next section investigates the teacher and school factors that are significantly related to within-school disparities in performance between girls and boys. It first focuses on gender disparities by discussing the

direction and size of school-level gender gaps. School-level disparities in outcomes between girls and boys are defined as the difference between the average school-level PISA score for girls minus the average school-level PISA score for boys. Therefore, differences are positive when they are in favour of girls and negative when they are in favour of boys.

The chapter then explores the relationship between the many teacher and school dimensions measured in TALIS and within-school disparities in student outcomes measured in PISA. It then examines some specific hypotheses related to policies that could play a role in reducing gender disparities in student achievement. Namely, this section looks at whether male teachers could help close the gap in reading and whether female teachers could help close the gap – especially when it comes to mathematics performance – through distinct teaching practices or by acting as role models. To harness the richness of the TALIS principal questionnaire, which includes specific questions related to gender equity, the section also explores the association between certain school policies and practices as well as teachers' attitudes to gender equity and student performance.

Differences in performance between girls and boys within schools

The inspection of TALIS-PISA link data shows that although the direction of the school-level gender gap varies across schools, even within the same country, there is a general pattern for each subject. In addition, this general pattern is mostly aligned with the country-level gaps in student performance as documented by PISA 2018 results. Notably, while girls tend to perform better than boys in reading, boys outperform, albeit to a lesser extent, girls in mathematics (OECD, 2019[7]). Gender disparities in science are negligible (OECD, 2019[7]).

In the case of student outcomes in reading, female students tend to significantly outperform their male peers in more than one-third of the schools (36%) on average across TALIS-PISA link countries and economies (Figure 4.6). However, there are 18% of schools on average across participating countries with same-gender students where within-school gender gaps cannot be estimated.[9] In CABA (Argentina), Denmark, Georgia and Turkey, when focusing solely on significant differences, girls perform better in reading than boys in more than 40% of the schools. On the other end of the spectrum, in Colombia, the share of schools with a significant gap in favour of girls is 30%. Moreover, in Malta only 7% of schools present a significant gap. Yet, Malta also stands out among TALIS-PISA link countries and economies in that around 60% of its schools are single-gender schools. Apart from CABA (Argentina) (1%) and the Czech Republic (8%), all other countries and economies have between 10% and 16% of schools with same-gender students. Subsequently, the main challenge of small sample sizes in relation to school-level analysis is an especially important concern in the case of Malta.[10] As the analyses of the following sections all consist of school-level analyses by country, they will not include results for Malta, given the very small number of available cases.

The gender pattern for mathematics and science is opposite to that of reading. On average across TALIS-PISA link countries and economies, boys significantly outperform girls in mathematics in 20% of the schools (Figure 4.6). In CABA (Argentina), Colombia and the Czech Republic, when focusing solely on significant differences, boys outperform girls in mathematics in more than 25% of the schools. In science, the difference between girls and boys is less pronounced. Boys tend to significantly outperform girls in science in 16% of the schools, while the opposite pattern is observed in 11% of the schools, on average across participating countries and economies. Boys perform better than girls in science in 20% of the schools or more in the aforementioned countries and economies (CABA [Argentina], Colombia and the Czech Republic).

Average within-school gaps in performance between female and male students for each country and economy participating in the TALIS-PISA link corroborates the finding that gender disparities are most important in reading. The average within-school difference in reading between girls and boys is 19 score points in favour of girls, while the gap in favour of boys is 13 score points for mathematics and 6 score

points for science, on average across participating countries and economies (Table 4.34). Average gender disparities in reading performance within schools is significant in six countries and economies, including Australia, CABA (Argentina), the Czech Republic, Denmark, Georgia and Turkey. In contrast, in mathematics, boys outperform girls on average within schools in four countries and economies – Australia, CABA (Argentina), Colombia and the Czech Republic. In the case of science, there are only two countries, Colombia and the Czech Republic, where a significant difference between girls and boys can be observed on average within schools.

However, TALIS-PISA link data suggest that there is room for schools to close gender gaps. The difference in reading performance between girls and boys is not statistically significant in 37% of schools on average in TALIS-PISA link countries and economies (Figure 4.6). Depending on the country/economy, this share varies between 27% (Malta) and 47% (CABA [Argentina]). Gender gaps in mathematics and science are not statistically significant in 55% of schools, on average across participating countries and economies. Of note, boys are not only able to perform equally well as (or not significantly differently than) girls in some schools but significantly outperform girls in reading in 9% of the schools. This share varies between 3% of the schools in Turkey and 14% of schools in Colombia and the Czech Republic (Figure 4.6). Similarly, girls are also able to perform better than boys in mathematics and even more so in science. Girls significantly outperform boys in mathematics in 7% of the schools on average across TALIS-PISA link countries and economies. In Australia and Turkey, this share increases to 11% while, in Colombia, there are almost no schools where girls seem to perform significantly better in mathematics than boys. The pattern is more balanced for science with more schools in which girls significantly outperform boys in science (11%; TALIS-PISA link average). There is even one country – Georgia – where the share of schools where girls outperform boys in science (21%) is greater than the share of schools where boys perform better (9%).

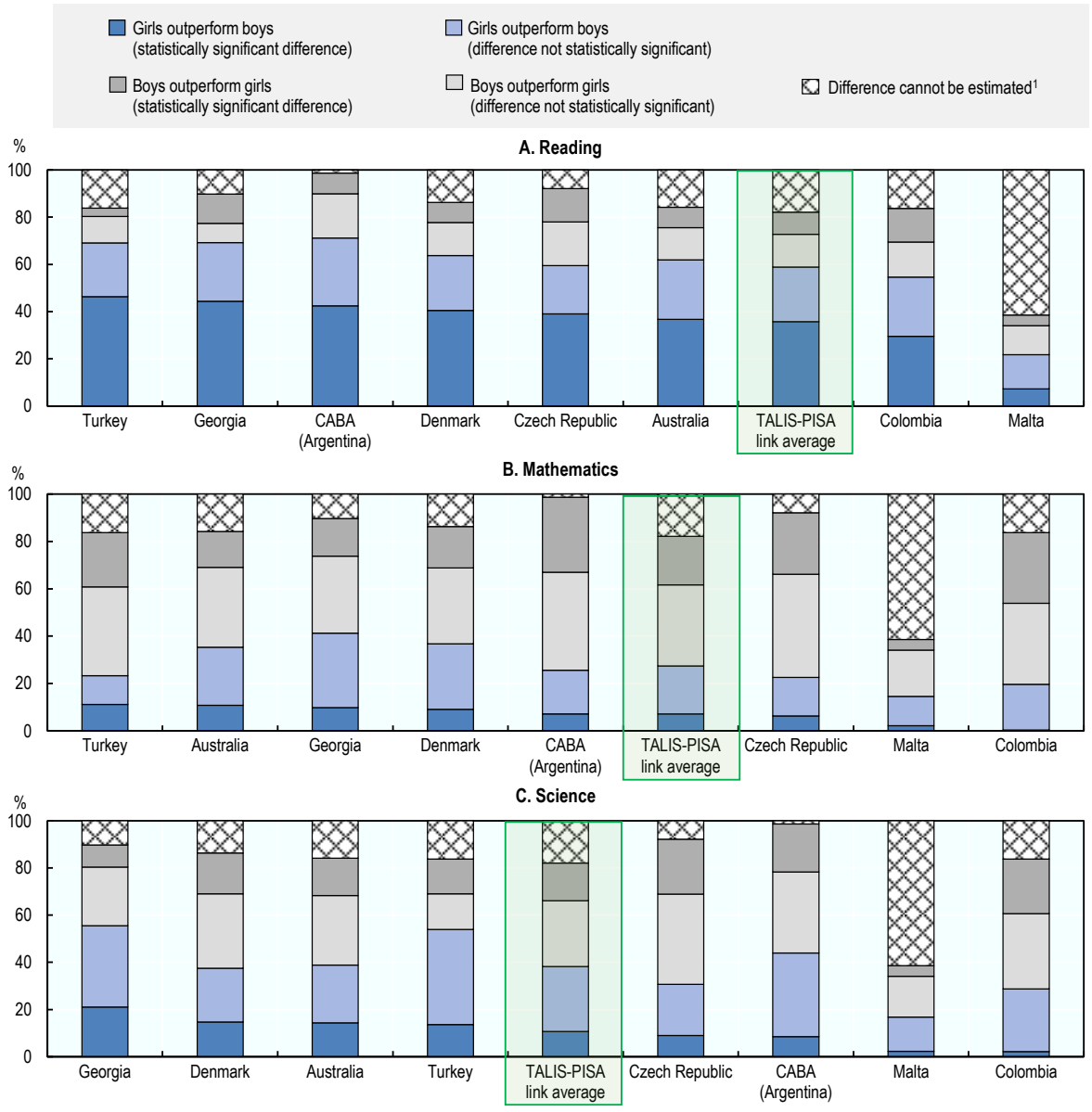
Teacher and school factors that matter for gender equity in achievement within schools

In each round of PISA, one out of the three domains of competence – reading, mathematics and science – is tested in detail, taking up nearly half of the total testing time. In 2018, reading was the focus. As reading literacy is measured more in-depth compared to mathematics and science within the latest TALIS-PISA link data, it is considered the most suitable subject for analyses applied on small samples. Therefore, this section focuses on student performance in reading. Due to low sample sizes, this section considers all teachers, not only reading teachers, when averaging teacher data at the school level. Focusing solely on reading teachers would lead to further loss of observations as that approach would require the exclusion of schools without any reading teachers sampled from the analysis.

Lasso regressions provide a data-driven approach to identifying which of the almost 150 potential predictors of the 18 teacher and school dimensions are significantly related to gender disparities in reading performance within schools. Lasso regression results suggest that almost half of teacher and school dimensions matter for within-school differences in reading performance between girls and boys when the overall population of 15-year-old students, teachers and principals surveyed within the TALIS-PISA link are considered (Figure 4.7). The eight dimensions highlighted by lasso regression analysis encompass teacher and school dimensions as well as factors with direct and indirect effects on student achievement. These dimensions are: teachers' classroom practices, teachers' motivation to join the profession, teachers' self-efficacy, school culture, teachers' participation in professional development activities of certain type and content, teacher collaboration, teachers' employment status and school leadership.

Figure 4.6. Gender disparities in student achievement within schools

Percentage of schools, by type of within-school gender disparity and by subject



1. Single-gender schools (i.e. all students surveyed in the school are same-gender students).

Notes: Within-school differences in performance between girls and boys are defined as the school-level average PISA score for girls minus the school-level average PISA score for boys. Differences are positive when they are in favour of girls and negative when they are in favour of boys. The TALIS-PISA link average corresponds to the arithmetic mean of the estimates of participating countries and economies, excluding Viet Nam. *Countries and economies are ranked in descending order of the percentage of schools characterised by a statistically significant positive difference in performance between girls and boys.*

Sources: OECD, TALIS 2018 Database; OECD, PISA 2018 Database, Tables 4.31, 4.32 and 4.33.

StatLink https://doi.org/10.1787/888934224125

Figure 4.7. Teacher and school factors that matter for within-school disparities in reading performance between girls and boys, based on lasso

Dimensions and variables selected by lasso regression based on responses of the overall population of 15-year-old students, teachers and principals surveyed within the TALIS-PISA link

Dimensions	Variables selected	Within-school differences in PISA score in reading between girls and boys[1] (sign of standardised coefficients: +/-)
Teacher dimensions with a direct effect on student achievement		
Classroom practices	Teachers' perceived disciplinary problems *(higher values indicate higher need for classroom discipline)*	+
Teacher dimensions with an indirect effect on student achievement		
Teacher characteristics	*No variables selected*	
Motivation to join the profession	Personal utility value	+
	Teaching as a first career choice	+
Initial education and training	*No variables selected*	
Well-being and job satisfaction	*No variables selected*	
Self-efficacy	Self-efficacy in instruction	-
Working hours	*No variables selected*	
School dimensions with a direct effect on student achievement		
Classroom characteristics (*classmates' characteristics and class size*)	*No variables selected*	
School culture	Collaborative school culture	+
	Stakeholder (i.e., parents and local community) involvement in school	-
School dimensions with an indirect effect on student achievement		
Induction	*No variables selected*	
Mentoring	*No variables selected*	
Professional development	Type: Reading professional literature	-
	Content: Teaching in a multicultural or multilingual setting	+
Feedback	*No variables selected*	
Collaboration	Professional collaboration	+
School innovativeness	*No variables selected*	
Employment status	Full-time (more than 90% of full time hours)	-
Formal appraisal	*No variables selected*	
School leadership	Principals' leadership activities: Observed instruction in the classroom	+

1. Within-school differences in performance between girls and boys are defined as the school-level average PISA score for girls minus the school-level average PISA score for boys. Differences are positive when they are in favour of girls and negative when they are in favour of boys.
Notes: Country fixed effects and student characteristics averaged at the school level, such as share of female students, share of students with an immigrant background and index of economic, social and cultural status, are always included among the variables selected by lasso.
Teacher variables are averaged for all teachers within the school.
Dimensions that are not selected are highlighted in light grey. Since lasso is applied as a model selection technique, it does not provide the standard errors required for performing statistical inference. The interpretation of the estimated standardised coefficients is conditional on the selected model and cannot be interpreted as causal. Moreover, in the presence of correlated explanatory variables, the signs of the coefficient estimates can swing based on which other independent variables are in the model.
For additional information on the full list of potential variables included in the lasso regressions, as well as more information on lasso in general, see Annex B.
Sources: OECD, TALIS 2018 Database; OECD, PISA 2018 Database, Table 4.35.

Besides lasso regressions, one can also select the teacher and school dimensions that matter (the most) for within-school disparities in reading performance between girls and boys by identifying the dimensions that explain the highest shares of variance in within-school disparities. Although this approach cannot highlight the specific factors within a dimension that may matter the most for student achievement, it complements the findings of the lasso regression by revealing the relative importance of each teacher and school dimension in explaining the differences in within-school gender disparities in student achievement.

However, it is important to note that the shares of variance explained by each dimension may be artificially driven by the number of variables included in a given dimension. The dimensions that have the lowest explanatory power, such as school innovativeness, collaboration, mentoring, employment status and teacher characteristics, include four or fewer variables, while the dimensions that explain larger shares of the differences in school average performances include between seven and 14 variables (see more information in Annex B). Moreover, the observed explanatory power of the dimensions may also be inflated due to the low sample sizes. Thus, caution is warranted when interpreting these results.

Yet, with the aforementioned advantages and limitations in mind, it is possible to identify teacher and school dimensions that explain a substantial part of the differences in gender disparities in student performance within schools. The teacher and school dimensions that explain more than 20% of the variation in within-school gender gaps include teachers' participation in professional development activities of certain type (25%) and content (35%), teachers' initial teacher education, both in terms of content (35%) and sense of preparedness (22%), classroom characteristics (29%), teachers' classroom practices (29%), teachers' use of working time (29%), school leadership (26%) and teachers' formal appraisal (24%) (Figure 4.8).

In total, 12 dimensions are highlighted by either lasso or their explanatory power or both. Yet, based on the country-level regression results by each dimension taken separately, only five of these dimensions show a clear cross-country pattern in relation to gender disparities in reading performance within schools.[11] These include teachers' classroom practices, teachers' motivation to join the profession, school culture, teachers' formal appraisal and school leadership. The next section examines these five teacher and school dimensions more in detail at the country level. It is important to stress that, similarly to the lasso regression results, causal interpretation of the country-level regressions is not possible. All the results presented below are correlational and should be interpreted accordingly.

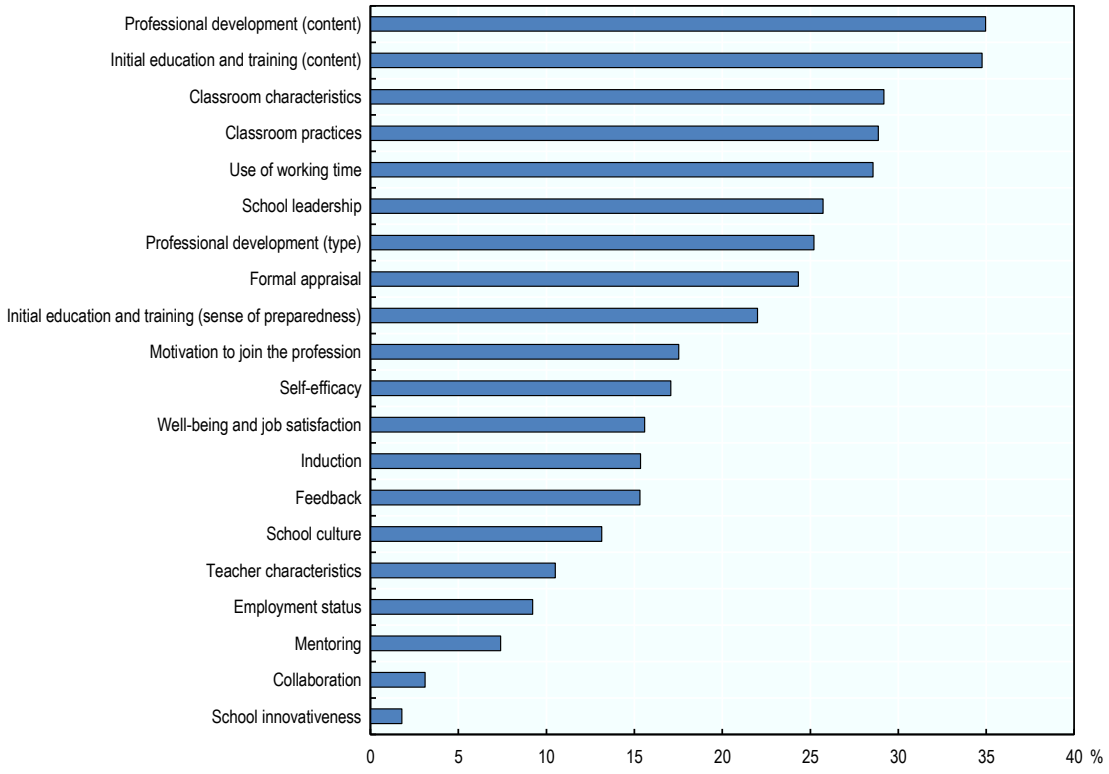
Teachers' classroom practices

Teachers' classroom practices are an important factor to consider in relation to gender gaps in student reading performance. They are highlighted by the lasso regression and explain a significant share (29%) of variance in within-school gender disparities in reading performance (Figure 4.7 and Figure 4.8). Country-level regression results reveal that two aspects of teachers' classroom practices stand out in their relation to gender gaps in reading achievement: teachers' perception of classroom disciplinary climate and the frequency with which teachers administer their own assessment to students.

First, as the extent of disciplinary issues perceived by the average school teacher increases, the greater the difference in PISA reading scores between girls and boys within schools is – favouring girls – on average across the countries and economies participating in the TALIS-PISA link, as well as in the Czech Republic, Georgia and Turkey (Figure 4.9). Boys might be more affected by a deteriorated classroom climate as they tend to be exposed to greater peer pressure than girls. They may also be more likely to disturb classes. Therefore, disciplinary issues may be more detrimental to boys' performance compared to girls'. These results also suggest that teachers' classroom management skills may matter for mitigating the gap in reading performance between girls and boys within schools.

Figure 4.8. Differences in within-school gender disparities in student achievement explained by teacher and school factors

Percentage of variance in within-school differences in the PISA reading score between girls and boys; explained by each dimension (TALIS-PISA link average)



Notes: Teacher variables are averaged for all teachers within the school. Within-school differences in performance between girls and boys are defined as the school-level average PISA score for girls minus the school-level average PISA score for boys. Differences are positive when they are in favour of girls and negative when they are in favour of boys.
The TALIS-PISA link average corresponds to the arithmetic mean of the estimates of participating countries and economies, excluding Malta and Viet Nam.
Values are ranked in descending order of the percentage of variance in within-school differences in the PISA reading score between girls and boys, explained by each dimension.
Sources: OECD, TALIS 2018 Database; OECD, PISA 2018 Database, Table 4.36.

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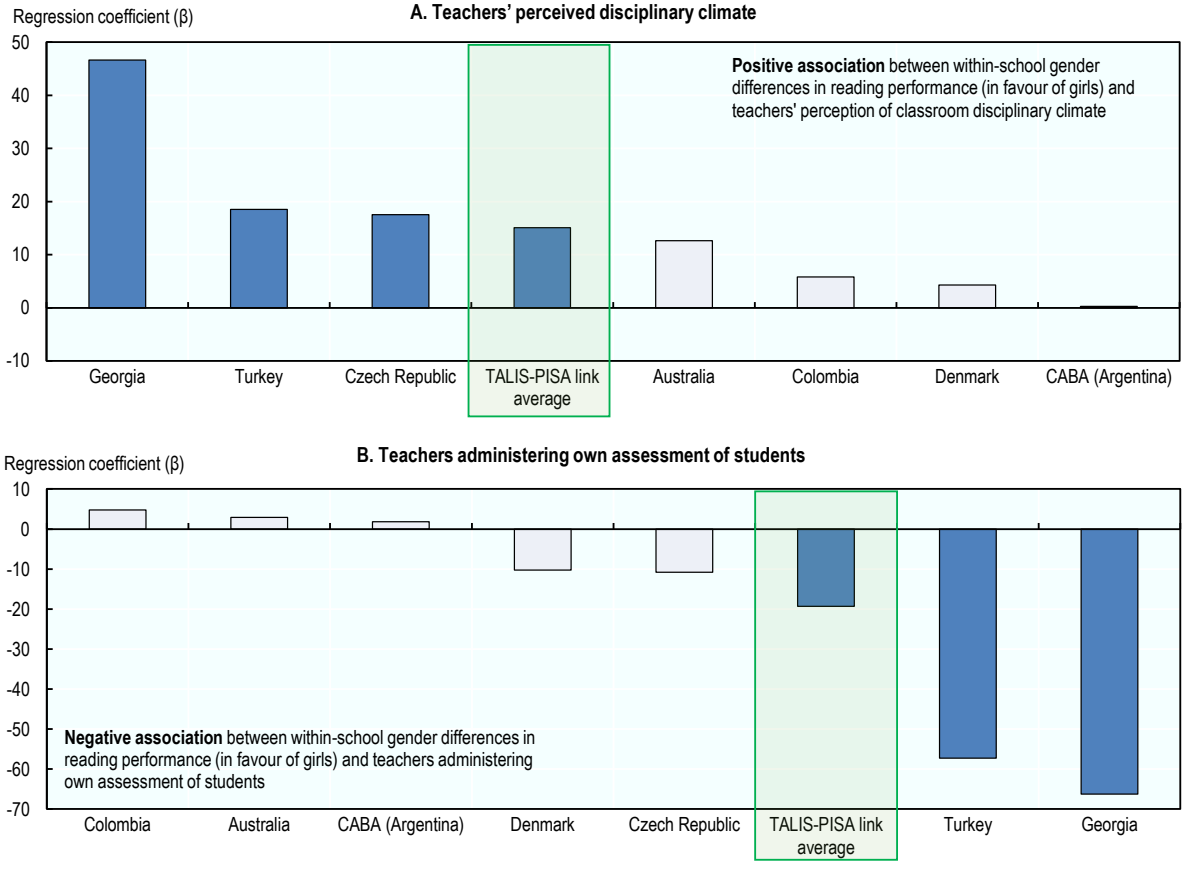
Figure 4.9. Relationship between within-school gender disparities in reading and teachers' classroom practices

Change in within-school gender disparities in the PISA reading score associated with teachers' classroom practices



Notes: Results of linear regression based on responses of 15-year-old students and teachers. Controlling for the following classroom practices of teachers: class time spent on actual teaching and learning, teachers' autonomy over planning and teaching, use of practices related to clarity of instruction, use of practices related to cognitive activation, use of other assessment practices, such as providing written feedback on student work in addition to marking, letting students evaluate their own progress and observing students when working on particular tasks and providing immediate feedback; and for the following student characteristics averaged at the school level: gender, immigrant background and index of economic, social and cultural status.

Within-school differences in performance between girls and boys are defined as the school-level average PISA score for girls minus the school-level average PISA score for boys. Differences are positive when they are in favour of girls and negative when they are in favour of boys. Teacher variables are averaged for all teachers within the school.

The TALIS-PISA link average corresponds to the arithmetic mean of the estimates of participating countries and economies, excluding Malta and Viet Nam.

Statistically significant coefficients are marked in a darker tone (see Annex B).

Countries and economies are ranked in descending order of the change in within-school gender disparities in the PISA reading score associated with teachers' classroom practices.

Sources: OECD, TALIS 2018 Database; OECD, PISA 2018 Database, Table 4.37.

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Second, the more often teachers evaluate their students with their own assessment, the smaller the difference in reading performance reading between girls and boys, with boys enjoying the advantage. This holds true on average across all countries as well as in Georgia and Turkey (Figure 4.9). This finding suggests that boys benefit from more regular testing as it allows them to better self-regulate and focus on schoolwork. Research shows that a learning-oriented environment is especially beneficial for boys (Legewie and DiPrete, 2012[53]). Such an environment can shape how masculinity is constructed in peer

culture among boys and, thereby, influence boys' orientation toward school. Yet, it is also possible that girls benefit less from more frequent assessment by teachers due to their increased anxiety about frequent testing and induced competition (Devine et al., 2012[54]; Gneezy, Niederle and Rustichini, 2003[55]; McLean and Anderson, 2009[56]; Niederle and Vesterlund, 2011[57]), even though they may be better at sustaining their performance during longer tests (Balart and Oosterveen, 2019[58]). PISA 2018 results show that, in the majority of participating countries and economies, boys were more likely to express more positive attitudes towards competition than girls (OECD, 2019[7]).

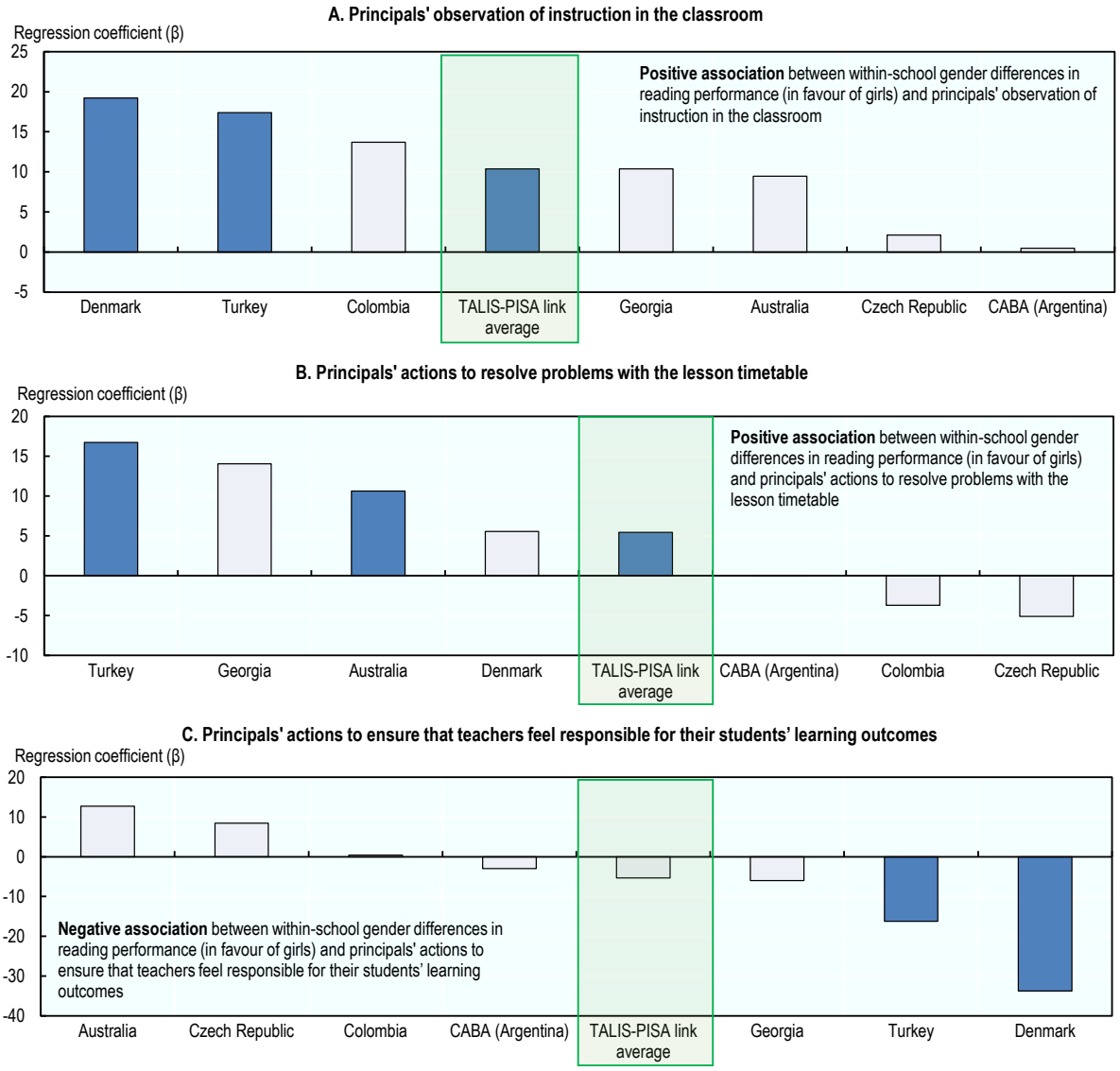
School leadership

Findings of lasso regression analysis presented above highlighted school leadership, in particular the frequency with which principals reported observing instruction in the classroom as an important predictor for within-school differences in reading performance between girls and boys (Figure 4.7). School leadership was also highlighted above as a dimension that explains a substantial share (26%) of the variation in gender-related disparities in student achievement (Figure 4.8). Country-level regression results are in line with these findings. On average across participating countries and economies as well as in Denmark and Turkey, schools whose principals tend to observe instruction in the classroom more often are characterised by larger differences in reading performance in favour of girls (Figure 4.10). This finding suggests that, compared to boys, girls may gain more from direct forms of instructional leadership activities such as observing instruction in the classroom. This may be the case, for instance, if girls find extra motivation to focus on schoolwork in schools where there is extended control and oversight from the school leader on what happens in classrooms. Nevertheless, this finding might also point to a reverse causal relation, with school leaders engaging more in instructional leadership activities in classes and schools with a higher share of low-achieving boys.

Country-level regression results also suggest that two other activities of school leaders present some association with gender gap in achievement: dealing with the school timetable and fostering teachers' feeling of responsibility for their students' achievement. First, the more often school leaders engage in resolving problems with the lesson timetable in the school, the larger the outperformance of girls over boys in reading performance. This holds true on average across countries and economies as well as in Australia and Turkey (Figure 4.10). This finding suggests that boys are more disturbed than girls in their learning by practical organisational issues occurring in the school. This corroborates, once again, the fact that girls are more able to stay focused than boys,[12] regardless of problems arising. This echoes several research studies suggesting that, for many boys, it is not acceptable to be seen as interested in school work (DiPrete and Buchmann, 2013[39]). Boys adopt attitudes that include a disregard for authority, academic work and formal achievement (Salisbury, Rees and Gorard, 1999[59]), which might express more acutely when there are practical and organisational disruptions in the school. Second, the more school leaders ensure that teachers feel responsible for their students' learning outcomes, the better boys perform in reading compared to girls. This holds true in Denmark and Turkey (Figure 4.10). This kind of instructional leadership might be particularly efficient in motivating teachers to support boys and, in particular, low-achieving boys. It might also be the case that boys are more stimulated than girls in a school environment when a significant weight is given to performance and accountability. In fact, this resonates with the finding presented above about boys benefiting more from more regular testing – a school environment where accountability manifests in frequent testing may be especially beneficial for boys. It may allow them to better self-regulate and focus on schoolwork as boys also tend to express more positive attitudes towards competition than girls.

Figure 4.10. Relationship between within-school gender disparities in reading and school leadership

Change in within-school gender disparities in the PISA reading score associated with principals' leadership activities



Notes: Results of linear regression based on responses of principals and 15-year-old students. Controlling for the following leadership activities of principals: collaborating with teachers to solve classroom discipline problems, providing feedback to teachers, supporting co-operation among teachers to develop new teaching practices, ensuring that teachers take responsibility for improving their teaching skills, providing parents or guardians with information on the school and student performance, reviewing school administrative procedures and reports, collaborating with principals from other schools on challenging work tasks and working on a professional development plan for the school; and for the following student characteristics averaged at the school level: gender, immigrant background and index of economic, social and cultural status.
Within-school differences in performance between girls and boys are defined as the school-level average PISA score for girls minus the school-level average PISA score for boys. Differences are positive when they are in favour of girls and negative when they are in favour of boys. Teacher variables are averaged for all teachers within the school.
The TALIS-PISA link average corresponds to the arithmetic mean of the estimates of participating countries and economies, excluding Malta and Viet Nam.
Statistically significant coefficients are marked in a darker tone (see Annex B).
Countries and economies are ranked in descending order of the change in within-school gender disparities in the PISA reading score associated with principals' leadership activities.
Sources: OECD, TALIS 2018 Database; OECD, PISA 2018 Database, Table 4.38.

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School culture

School culture explains a relatively low share of the variation in within-school gender differences, i.e. only 13% on average across participating countries and economies (Figure 4.8). Yet, school culture is selected by lasso as a key predictor of gender gaps in reading. In particular, having a collaborative school culture and stakeholders such as parents and local community involved in school-related activities are significantly associated with gender disparities in reading performance within schools (Figure 4.7). Country-level regression results show consistent cross-country patterns for certain indicators of school culture. This is the case for stakeholder involvement in school as well as teacher-student relations, which both seem to matter for school-level gender differences in reading performance (Table 4.39). Notably, in Colombia and Denmark, within-school disparities in reading performance between girls and boys tend to decrease in favour of boys in those schools where stakeholders (i.e. parents and community) are involved in school-related activities (Figure 4.11). Similarly, in schools where the average school teacher consider teacher-student relationships to be positive, gender disparities in reading performance are smaller, in favour of boys, in Australia, Colombia and on average across participating countries and economies (Figure 4.11). These findings suggest that girls may be better at self-regulating and staying focused on their school work while boys may need more support from their parents. They may also benefit more from a positive relationship with their teachers.

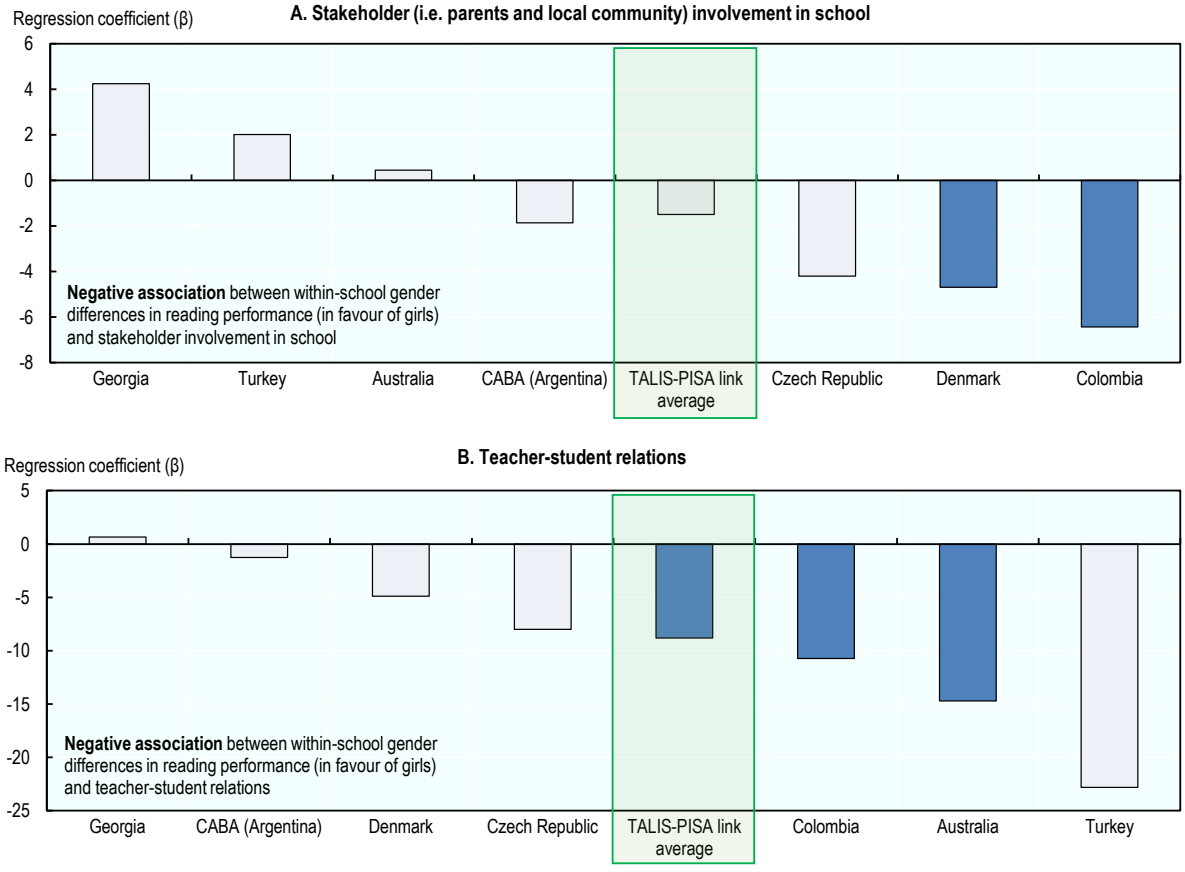
Teachers' formal appraisal

The dimension of formally appraising teachers is not selected by lasso as an important predictor for within-school gender disparities in reading performance (Figure 4.7). However, it explains a substantial part (24%) of the variation in school-level gaps in PISA reading scores between girls and boys (Figure 4.8). Country-level analysis reveals a significant association between features of teachers' formal appraisal and school-level gender differences in reading performance that holds in various countries. Notably, the more external individuals and bodies formally appraise teachers in the school, the more likely boys will perform as well as (if not better than) girls in reading on average across participating countries and economies as well as in Denmark, Georgia and Turkey (Table 4.40). This finding indicates that formal evaluation of teachers may not only be an important element of high-performing schools, especially when it has a strong focus on teachers' continuous improvement (OECD, 2018[60]), but it can also address gender disparities in student achievement. Teacher appraisal can encourage teachers to reflect on and improve their teaching practices. Improved classroom management practices, for example, may benefit boys more than girls.

External teacher appraisal sources can be perceived as more objective and less judgemental than appraisal by the school management team or other colleagues who work in the same school (OECD, 2020[26]). It can also happen in a wide variety of forms involving very different individuals or bodies. Thus, it is difficult to draw general conclusions regarding formal evaluation of teachers by external sources. The association found between teachers' formal appraisal and within-school gender disparities in reading performance may simply point to the importance of formal appraisal in mitigating gender disparities in student achievement, irrespective of the source of the teacher evaluation.

Figure 4.11. Relationship between within-school gender disparities in reading and school culture

Change in within-school gender disparities in the PISA reading score associated with school culture



Notes: Results of linear regression based on responses of principals, teachers and 15-year-old students. Controlling for the following aspects of school culture: collaborative school culture and teachers' actions towards achieving academic excellence; and for the following student characteristics averaged at the school level: gender, immigrant background and index of economic, social and cultural status.
Within-school differences in performance between girls and boys are defined as the school-level average PISA score for girls minus the school-level average PISA score for boys. Differences are positive when they are in favour of girls and negative when they are in favour of boys. Teacher variables are averaged for all teachers within the school.
The TALIS-PISA link average corresponds to the arithmetic mean of the estimates of participating countries and economies, excluding Malta and Viet Nam.
Statistically significant coefficients are marked in a darker tone (see Annex B).
Countries and economies are ranked in descending order of the change in within-school gender disparities in the PISA reading score associated with school culture.
Sources: OECD, TALIS 2018 Database; OECD, PISA 2018 Database, Table 4.39.

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Teachers' motivation to join the profession

Teachers' motivation to join the profession explains a relatively low share (18%) of the variation in within-school gender differences on average across participating countries and economies (Figure 4.8). Nevertheless, this teacher factor is selected by lasso. In particular, two of its indicators – the share of teachers for whom teaching was a first career choice as well as the weight given by the school's teachers to personal-utility motivations when they considered joining the profession – have a significant relationship

with school-level differences in reading performance between girls and boys (Figure 4.7). Yet, the country-level regression results do not confirm these findings from lasso. Nevertheless, the relation between gender gaps within schools and the share of teachers who chose teaching as their first career holds both for the overall population surveyed within the TALIS-PISA link (through lasso) and across countries. As the share of teachers for whom teaching was a first career choice increases within schools, the differences in PISA reading scores between girls and boys tend to increase in favour of girls on average across countries as well as in the Czech Republic, Denmark and Turkey (Table 4.41). As shown in TALIS 2018, teachers whose first career choice was teaching are more likely to be satisfied with their job in almost all countries and economies participating in TALIS, and they also tend to report higher self-efficacy (OECD, 2019[28]). The combination of all these factors might be driving larger gender disparities in reading in favour of girls. Yet, the reasons that explain this finding are unknown, warranting the need for further research.

Teacher gender and attitudes in relation to gender disparities in student achievement

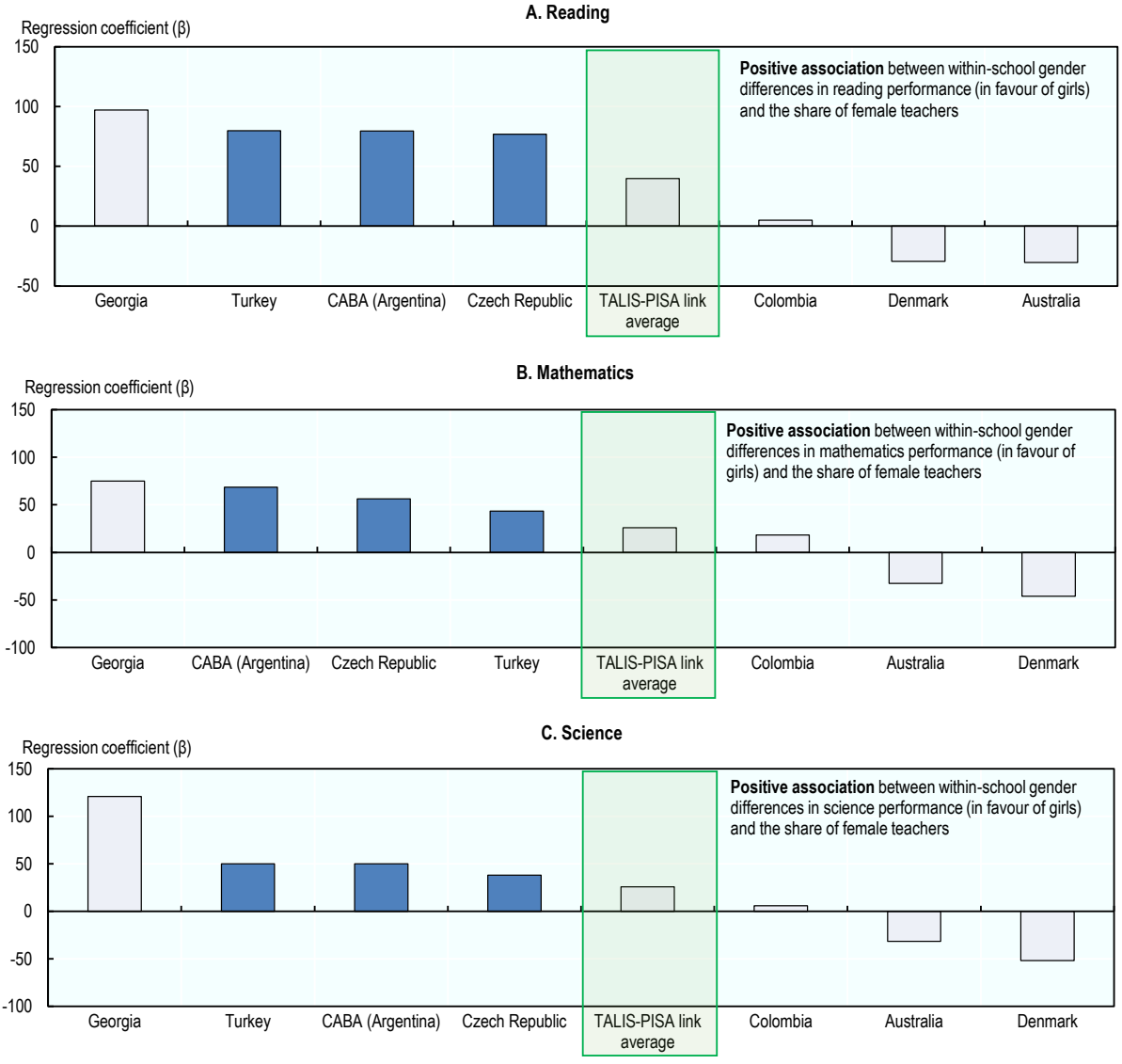
In the quest for teacher and school factors that can play a role in mitigating gender disparities in student performance, this section aims to test specific hypotheses about system-level policies and teachers' attitudes in relation to gender disparities in student performance in all three subjects (reading, mathematics and science). Do female teachers act as role models for girls, especially when it comes to closing the gender gap in mathematics or science? In the same way, can male teachers act as role models for boys to close the gender gap in reading performance? Do teachers' attitudes matter for gender disparities in student achievement? The TALIS principal questionnaire includes a question that focuses on teachers' attitudes towards gender discrimination, making it possible to examine whether teachers' beliefs can help to address gender gaps in student achievement.

TALIS-PISA link data suggest that teachers may act as role models for students of their gender. In CABA (Argentina), the Czech Republic and Turkey, as the share of female teachers increases in the schools, the differences in PISA scores between girls and boys also tend to increase in reading performance and decrease for mathematics and science in favour of girls (Figure 4.12). In the same way, as the share of male teachers increases in the school, the better boys perform compared to girls in all subjects. These results hold while accounting for the average school teacher's years of teaching experience. These findings suggest that, at least in certain education systems, teachers may have a bigger influence on students of their gender either because of distinct teaching practices that suit same-gender students better or by overcoming gender stereotypes because they are role models for these students.

The TALIS principal questionnaire has a specific question that asks school leaders about their views on teachers' attitudes regarding gender discrimination. Notably, it asks principals whether "none or almost none", "some", "many" or "all or almost all" teachers in the school would agree that students should learn how to avoid gender discrimination; it is important to treat female and male students equally. Country-level regressions results are not significant for most participating countries and economies (Tables 4.45, 4.46 and 4.47). Yet, in schools in Turkey where principals perceive that all or almost all teachers in the school would agree that it is important to treat female and male students equally, within-school gender disparities in student performance tend to increase in favour of girls. This result holds for reading, mathematics and science and it aligns with past research showing that the prevalence of gender stereotypes and gender gaps are closely related (Else-Quest, Hyde and Linn, 2010[42]; Guiso et al., 2008[43]; Nollenberger, Rodríguez-Planas and Sevilla, 2016[44]; Nosek, Banaji and Greenwald, 2002[45]).

Figure 4.12. Relationship between within-school gender disparities in student achievement and teachers' gender

Change in within-school gender disparities in PISA scores associated with teachers' gender, by subject



Notes: Results of linear regression based on responses of 15-year-old students and teachers. Controlling for teachers' average years of teaching experience; and for the following student characteristics averaged at the school level: gender, immigrant background and index of economic, social and cultural status.

Within-school differences in performance between girls and boys are defined as the school-level average PISA score for girls minus the school-level average PISA score for boys. Differences are positive when they are in favour of girls and negative when they are in favour of boys. Teacher variables are averaged for all teachers within the school.

The TALIS-PISA link average corresponds to the arithmetic mean of the estimates of participating countries and economies, excluding Malta and Viet Nam.

Statistically significant coefficients are marked in a darker tone (see Annex B).

Countries and economies are ranked in descending order of the change in within-school gender disparities in PISA scores associated with teachers' gender.

Sources: OECD, TALIS 2018 Database; OECD, PISA 2018 Database, Tables 4.42, 4.43 and 4.44.

StatLink https://doi.org/10.1787/888934224220

Summary

Two main sets of conclusions can be drawn from the findings based on country-level analyses of gender gaps in reading performance.

First, boys seem to be more disturbed than girls by classroom disciplinary problems and school organisational issues. Indeed, as the level of disciplinary issues perceived by the average school teacher increases, the difference in PISA reading scores between girls and boys within schools tends to increase further in favour of girls. In addition, the more often school leaders observe instruction in classrooms (most likely as a remedial measure) and resolve problems with the lesson timetable in the school, the larger the outperformance of girls over boys in reading. Boys might be more affected by deteriorated learning conditions as they tend to be exposed to greater peer pressure than girls. Boys may also be more likely to be the students disturbing lessons. Overall, they seem less able than girls to stay focused on their schoolwork when disciplinary or practical issues arise in school. The findings suggest potential measures to help boys close the gap with girls in reading: greater involvement and support from parents in school-related activities as well as positive relationships between teachers and students. This suggests that 15-year old boys, more than girls, need support from significant adults such as their parents and teachers to self-regulate and be achievement-focused.

Second, boys are more likely to perform as well as (or even better) than girls in reading in schools where a culture of student assessment, teacher accountability and appraisal prevails. The more often teachers evaluate their students by administering their own assessment, the smaller the difference in reading performance between girls and boys to the advantage of boys. This may suggest that boys benefit from more regular testing as it allows them to better self-regulate and focus on schoolwork. Yet, this might also be due to girls' increased anxiety about frequent testing and induced competition. In addition, the more school leaders ensure that teachers feel responsible for their students' learning outcomes and the more often teachers are formally appraised by external individuals and bodies, the better boys perform in reading compared to girls. This suggests that teacher accountability and appraisal could help to address gender disparities in student achievement. This could be the case, in particular, if teachers are given opportunities to reflect on their teaching practice and find ways to better support low- and middle-achievers among which boys are over-represented in reading.

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Notes

[1] TALIS-PISA link: Teaching and Learning International Survey (TALIS) and Programme for International Student Assessment (PISA) link covers schools that participated in both TALIS and PISA.

[2] Since Viet Nam does not have data on PISA test scores, it is not included in the analyses presented in Chapter 4.

[3] Analyses on socio-economic disparities in achievement within schools are available upon request to the authors of the report. Authors conducted analyses using two alternative definitions of socially disadvantaged and advantaged students. In the first approach, socially disadvantaged students were defined as those students who are in the bottom *quarter* of the PISA index of economic, social and cultural status (ESCS), and in the second approach those in the bottom *half*. Conversely, socially advantaged students are those in the top *quarter* of the PISA index of economic, social and cultural status, and in the second approach those in the top *half*. In the first approach, neither lasso regressions based on the overall population surveyed within the TALIS-PISA link, nor country-level regressions highlight teacher and school factors that may be significantly related to socio-economic disparities in student performance within schools. In the second approach, which is applied on an increased number of schools enrolling both types of students but implies, at the same, smaller socio-economic gaps within schools, lasso regressions do select quite a few dimensions as key predictors of socio-economic gaps in achievement within schools. However, the lasso findings do not align well with those from the country-level regressions, which are rather inconsistent. It was decided not to report these analyses, given their lack of robustness.

[4] Among the eight countries/economies with available performance data, four of them have too few schools that enrol both native and migrant students (Colombia, the Czech Republic, Georgia and Turkey). For the remaining four countries/economies, the number of schools with a significant within-school gap between migrant and non-migrant students is limited (especially in CABA [Argentina] and Malta).

[5] For instance, analysis based on TALIS data show that in the case of teachers' satisfaction with the profession, only a small percentage (i.e. 4%) of the total variance comes from differences between schools (OECD, 2020[26]).

[6] Based on findings from Rangvid (2007[15]), quantile regression results suggest differential school composition effects across the conditional reading score distribution, with students at the lower quantiles benefitting more from socially advantaged peers. Students at lower and higher quantiles of the conditional mathematics score distribution seem to benefit equally from attending schools with a better student intake. Finally, Rangvid's findings are at best marginally significant when it comes to the relationship between the school socio-economic composition and students' science test scores.

[7] The role of classmates' characteristics as confounding factors in the association between a teacher or school factor, and student achievement by level of performance was also explored. However, due to computational process (i.e. non-convergence of the quantile regression model), the estimates for the models including controls for classmates' characteristics were missing for certain countries. Therefore, the models that include controls for classmates' characteristics are neither reported nor commented on.

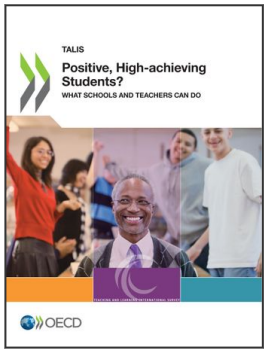
[8] Teacher gender bias was measured using class-gender differences in scores between school exams graded by teachers and national exams graded blindly by external examiners.

[9] Excluding Malta, where single-gender schools constitute around 60% of all schools, from the TALIS-PISA link average leads to a decrease in the share of same-gender schools without gender gap estimates of 6 percentage points from 18% to 12%.

[10] In Malta, there are only 17 out of the 44 schools surveyed that are not single-gender schools (i.e. all students surveyed in the school are same-gender students) and where the within-school differences in performance between girls and boys can be computed.

[11] Examining each of the remaining seven dimensions separately and more closely at the country-level – teachers' participation in professional development activities (both type and content), teachers' initial teacher education (both in terms of content and sense of preparedness), classroom characteristics, teachers' self-efficacy, teachers' employment status and teacher collaboration – shows very few significant results that would follow a consistent pattern across countries, hence provides little evidence for a significant relationship with school-level gender disparities in reading performance.

[12] For example, girls are overwhelmingly more likely than boys to spend time doing homework (OECD, 2015[8]).



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