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LEBANON

PISA 2018 NATIONAL REPORT

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Executive summary

In this report, we investigate the performance of students from Lebanon using data gathered from the 2018 Program for International Student Assessment (PISA) assessment. The aim of this investigation is to find the determinants of the educational achievements of Lebanese students, in order to design interventions which can target the issues that schools experience in the country. In the first chapter, we will focus on the features and the design of the PISA assessment. In particular, we will devote our attention to the participating countries, the requirements to take part in the test and the interpretation of its results. Moreover, we will briefly discuss the features of the Lebanese educational system. In the second chapter, we will investigate the results of Lebanese students in the domain of Reading. After a general overview of the results, in which the performance of Lebanese pupils will be compared to the one of students from other participating countries, we will turn our attention to the gender gap between girl and boy students. Lastly, we will account for the socio-economic context in which students live and how this can affect their performance in Reading.

The third and the fourth chapters follow the same structure as the previous one, focusing on different domains. The former is devoted to the analysis of the results in Mathematics, while the latter is instead devoted to the results in Science. In both cases, after the general overview, the gender gap and the socio-economic context will be accounted for. The last chapter concludes the report. After a brief summary of the findings, it will focus on the challenges that Lebanese students will face due to the impact of the ongoing COVID-19 pandemic on the educational system and its functioning.

The PISA assessment

PISA is a standardized test which is administered every three years since 2000 to 15-year-old students from participating countries. This assessment is aimed at measuring cross-curricular competencies which are necessary to successfully participate in society, and it is composed of three main domains, namely Reading, Mathematics and Science. Being a project developed and coordinated by the Organization for Economic Cooperation and Development (OECD), it is administered to countries which make up 90% of the world's economies.

The data provided, by a comparison of the performance of students between countries, can be used to identify and enhance policies and practices that support education. In fact, PISA does not only provide reliable assessment data, but also several crucial information related to attitudes, behavior, opinions of students and teaching practices, school organization, and system-level solutions in a given country. This data can be used to investigate possible associations and to explain the educational achievements of students; while it may be inappropriate to infer causal relationships, it is still possible to identify trends and differences. The last PISA assessment, which took place in 2018, has been administered to students from 79 countries, for a total of around 600 thousand students. The assessment has been administered via computer in the majority of countries, yet in some others – including Lebanon – the format has remained paper-based. The tests require students to respond to multiple-choice questions as well as open answers. In the tests, blocks of items of various difficulty are assigned to students, depending on their performance in earlier stages. Moreover, after completing the cognitive tests in the various domains, participating students answer a questionnaire on their background which includes their learning habits, their motivation, and family-related information. The performance of students in the test is estimated using responses to the test itself and the standard deviation of each sample.

In Lebanon, the country which will be the focus of this report, around 6 thousand students participated in the assessment. The implementation of the PISA assessment in Lebanon was led by the Center of Educational Research and Development, which was responsible for administering the tests and questionnaires, providing survey documentation and checking the required quality standards. In 2018, 320 schools were randomly selected to participate in the survey. In the first step,

302 schools responded, and after replacements 313 schools participated in the survey, with a total of 5,614 participating students. The initial response rate was 94%, increasing to almost 98% after replacements. The exclusion and response rates at the student level both met the OECD required standards, since the exclusion rate in Lebanon was just above 2% and the final student-level response rate was 91%. For a complete understanding of the results, it should also be noted that the sample of students participating in the PISA assessment is biased towards students attending public schools, which are a minority in the country but a majority in the PISA sample.

Achievements in Reading

In the domain of reading, the performance of Lebanese students has been more than 130 points below the international average, and the third-lowest overall. The best performing countries in this domain have been mostly Asian countries, in particular the inland provinces and the special administrative regions of China. The positive results in the reading assessment may reflect the many years of investments in the quality of education in the top-performing countries, and also the efforts made in order to prepare their students for international assessments of this type with a training for both teachers and students on how to get higher results.

In order to have a better picture of the achievements which also accounts for the inequalities within each country, it is possible to compare the share of students who reached scores corresponding to different proficiency levels in reading. As a benchmark, it can be said that the second level of proficiency in reading translates into the most elementary competencies which are generally assumed to be fully established in 15-year-old students. In Lebanon, 67.8% of 15-year-old students did not reach this second proficiency level in reading. Moreover, 6% of these students did not even obtain the minimum proficiency level. It can be also noted that the distribution of students on the different proficiency levels is skewed to the right, as opposed to a more normal-like distribution for the OECD average, indicating that there are many students who achieve only a low proficiency level and very few who are more proficient.

Another approach to distinguish the properties of the results in Lebanon is to determine the existing inequalities in achievements between the low-achieving (i.e., 10^{th} percentile) and the high-achieving students (i.e., 90^{th} percentile). By comparing these two values, the range of the inequalities can be determined and compared between countries. On average, the score of Lebanese lowest-achieving students was lower than the OECD average by 143 points, while the reading performance of the highest-achieving students in Lebanon was similar to the performance of the mean students on the OECD average. Moreover, it has been found that the high-achieving students overachieve in Lebanon, which can be seen as an indication of the fact that the low overall results in reading are mostly due to the underperformance of the low-performing students.

In terms of the existing gender gap, which is the difference between the achievements of girl and boy students, in Lebanon the disparity in reading is at the advantage of girls, since they outperformed boys by around 8%. Yet, both for boys and girls, the distribution of the results along proficiency levels is skewed to the right, indicating significantly larger shares of students in the lowest proficiency levels. When accounting for the impact of socioeconomic status on the average performance, it can be observed that the correlation is positive and strong. Nonetheless, in Lebanon, students underperform in reading compared to what would be predicted given their socioeconomic status.

Achievements in Mathematics

In mathematics, the performance of Lebanese students has been less than 100 points lower than the OECD average, and Lebanon ranked 67th out of the 79 participating countries and economies. It should be mentioned that given the characteristics of this domain, the language barrier may have played a lesser role in determining the results, which might have instead been biased in the reading domain given the low familiarity with the language of the assessment (even if English is taught in Lebanese schools, it is at a much lower level than Arabic). As before, the best performing countries have been mostly Asian countries, in particular the inland provinces and the special administrative regions of China.

As before, in order to have a better picture of the achievements, which can also account for the existing inequalities within each country, it is possible to compare the share of students who reached scores corresponding to different proficiency levels. The second level of proficiency in mathematics again translates into the most elementary competencies which are assumed to be established in 15-year-old students. In Lebanon, more than one third of the students participating in PISA does not even reach the first level of proficiency, and almost 60% did not reach the second level. Even more than in the case of reading, the distribution of the results across the proficiency levels in mathematics is significantly skewed to the right, indicating that only a very few students reach the highest levels of proficiency.

Also for the case of mathematics, it is possible to compare the inequalities between the low-achieving (i.e., 10th percentile) and the high-achieving students (i.e., 90th percentile). Lebanese low-performing students obtained the fourth lowest score in the mathematics assessment among participating countries and economies, which indicates a critical situation of the lowest-achieving students in Lebanon. On the other hand, Lebanese high-achieving students have obtained on average 70 points less than the OECD average, indicating the existence of large disparities in the position of the low-achieving and high-achieving students, as well as the existence of significant difficulties for students in the domain of mathematics.

In terms of gender gap, in the case of mathematics the better results have been achieved by boys compared to girls, yet the difference is not statistically significant in Lebanon after the adjustment of the results. As before, both for boys and

girls the distribution of the results along proficiency levels is skewed to the right, indicating larger shares of students in the lowest proficiency levels. Similarly, when accounting for the impact of socioeconomic status on the average performance in mathematics, it can be observed that the correlation is positive and strong and that Lebanese students underperform compared to what would be predicted given their socioeconomic status.

Achievements in Science

In the domain of science, the performance of Lebanese students has been 105 points lower than the average of the OECD countries, with the country ranking 7th last of all the participating countries and economies. While the best results have been obtained by Asian and North-European countries, it should be noted that the performance of Lebanese students has also been lower than the one of students from neighboring countries such as Jordan, Cyprus, Turkey, Qatar and the United Arab Emirates.

As before, to have a better picture of the achievements accounting for the inequalities within each country, a comparison of the percentages of students who reached scores corresponding to different proficiency levels can be made. As in the previous domains, the second level of proficiency in science translates into the basic competencies that should be well established in 15-year-old students. Yet, the data show that almost two thirds of Lebanese students did not reach the second level of proficiency, and less than 1% reached the highest level. The fact that the distribution of the results along the different levels of achievements is again skewed to the right indicates that the situation is strongly unbalanced towards the low-achieving students.

Also for the case of science, it is possible to compare the inequalities between the low-achieving (i.e., 10th percentile) and the high-achieving students (i.e., 90th percentile). The position of the low-achieving students is low in the ranking, as Lebanon can be found in 76th place out of 79 surveyed countries and economies, with a score lower by 120 points than the average of the OECD countries and economies. On the other hand, a positive result is that the position of the high-achieving students is instead 24 points higher than the OECD average performance. These observations are nonetheless consistent with the findings from the previous domains, namely that the low performance of Lebanese students in the science assessment is significantly influenced by the underperformance of low-performing students.

In science, gender gaps appear to be as low as it was in the case of mathematics. In Lebanon, girls outperform boys but the magnitude of the difference in performance is not statistically significant. As in the previous domains, the distribution

of boy and girl students along the proficiency levels is again strongly skewed to the right, indicating that there is a large share of students who do not reach the most elementary competencies in science. Accounting for the effect of socioeconomic status shows that the results of Lebanese students are lower than what would be predicted by the correlation between the social and economic context and the educational attainments in science.

Future challenges for the Lebanese educational system

Lebanon has faced several challenges in recent years, including a significant inflow of refugees from Syria and the explosion in the Port of Beirut, which have strongly impacted an already difficult social and economic situation. In addition, the outbreak of the COVID-19 pandemic, in addition to the economic damages, might have also further weakened an educational system which was already paying the price of the existing issues. This is the case because it has been found that the poor social and economic context generates students whose performance is so poor that it substantially alters the distribution of the results in the whole country, and across the different domains surveyed by the PISA assessment.

Due to the COVID-19 pandemic, Lebanese schools have been closed for the first time at the beginning of March 2020, partially re-opened for short periods in the following school year and currently re-opened fully (as of the school year 2021-2022). The switch to remote learning might have meant that the most disadvantaged students, who are not equipped with the appropriate tools for distance learning, may have experienced even further challenges. This might have caused further difficulties both in absolute terms and in relative ones, when their performance is compared to the one of students from more affluent backgrounds.

In addition, the economic crisis stemming from the pandemic may impact families and worsen already existing issues, which can in turn affect the educational outcomes. The observable influence of socioeconomic status is expected to increase in the following years, and policies aimed at improving the performance of students should remain targeted on the inequalities in economic and social status, since they can have a very substantial impact on the attainments of students and their prospects in life.

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Chapter 1. What is the OECD PISA? How was it implemented in Lebanon?

What is PISA

The Program for International Student Assessment (PISA) is an international large-scale examination that offers insights for education policies and practices. PISA assesses the performance of 15-year-old students in reading, mathematics and science. PISA also includes measures of "real life" tasks that are considered relevant for a full and effective participation in modern society and for life-long learning, such as financial literacy and problem-solving. PISA questionnaires for schools and students are designed to enable collecting supplementary information, with the addition of data from teachers and parents in some countries. Since it was first performed in 2000, more than 3 million students from more than 90 countries have participated in PISA.

PISA includes measures of general cross-curricular competencies necessary for the participation in society and of how students apply these competencies to problems they may encounter in real-life. The assessment emphasizes functional skills such as reasoning, interpretation, and analytical skills. PISA includes three main domains:

- Reading Literacy refers to the capacity of students to understand and apply knowledge, evaluate, reflect on, and engage with texts to solve problems in a variety of situations, as well as achieve one's goals and broaden one's knowledge and potential.
- Mathematics Literacy tests the ability of students to formulate, employ, and interpret mathematics and apply mathematical knowledge to solve problems set in real-world contexts. To solve these problems, students must activate a number of mathematical competencies and use mathematical concepts, facts, procedures, and tools, as well as a broad range of mathematical contents.
- Science Literacy refers to the ability of students to engage with issues and ideas related to science. According to PISA, a scientifically literate student is a person who is keen on engaging in reasoned discourses about science and technology. The competencies required to engage in such discourse include

scientifically explaining phenomena, evaluating and designing scientific inquiries, and scientifically interpreting data and empirical evidence.

PISA is a program that has been implemented every three years since 2000, and each time the emphasis has been put on a different key domain. In the first PISA assessment that took place in 2000, the major domain was Reading literacy, which was the major domain also in 2009 and 2018. In the 2003, 2012 and upcoming 2022 PISA assessment, Mathematics took over as a major domain, while in 2006 and 2015 Science was the major domain. In more recent cycles of PISA, additional innovative and minor domains have been developed and further added to the assessment. For instance, Creative Problem Solving was added as a minor domain in 2012, while in 2015 Collaborative problem solving was added as an innovative domain. Three years later the Global Competence domain was added, and Creative Thinking has been chosen as the innovative domain for the upcoming 2022 cycle. The PISA assessment framework is continuously revised using the knowledge of expert groups and insights from the participating countries. Moreover, the assessment frameworks for PISA 2015 and PISA 2018 were adjusted to reflect the computer-based test delivery. The eighth cycle of PISA was due to take place in 2021, but it has been postponed to 2022 due to the ongoing COVID-19 pandemic.

PISA is a project proposed and coordinated by the Organization for Economic Co-operation and Development (OECD). The OECD is an international organization that currently has 37 member countries, but nonetheless also closely cooperates with several non-member countries[1]. The OECD conducts research on 88 countries, which make up 90% of the world's economies. The OECD Directorate for Education has found that student achievement in math and science are a sound indicator for future economic health and consequently countries with better education can expect more stable and prosperous economies The goal of the OECD is to "shape policies that foster prosperity, equality, opportunity, and well-being for all," and education policy is an important area of its activity. PISA is the largest international survey regarding education run by the OECD, and it also collects a vast number of economic and socio-demographic data. The conduction of PISA remains a joint effort of the

[1] see www.oecd.org for more details

OECD member and partner countries, and for this reason intergovernmental organizations are appointed to implement it.

As it has been mentioned, the PISA assessment is administered to 15-year-old students in 88 countries, regardless of grade, achievement, and socio-economic status. More precisely, the students tested by PISA are aged between 15 years and 3 months and 16 years and 2 months at the beginning of the assessment period. While home-schoolers and mentally disabled students are excluded from the assessment, the overall exclusion rate is below 5%. A threshold that guarantees the representativeness of the sample is set through a response rate from schools: in order to fulfil this requirement, each participating country must draw a sample of at least 5,000 students. In countries that do not have 5,000 students per year, an entire age cohort is tested instead. Some countries even use larger samples than required to allow for a comparison between regions. The exact population coverage and the response rates for each country are discussed below.

The goal of PISA is to compare student performance across countries at the crucial age of 15, nearing the end of compulsory education. Doing this, the assessment reveals what students in the highest-performing systems can do and what can be done to improve education. PISA also provides important insights about how an education system can equip students with the skills and knowledge that guarantee success in further education, on the labor market, and which ensure a successful participation in a technology-driven society. Moreover, it allows policy-makers around the world to gauge the knowledge and skills of students in their own countries in comparison with those in other countries, set policy targets against measurable goals achieved by other education systems, and learn from policies and practices applied elsewhere.

Since 2000, the PISA assessment has been implemented seven times, with more than 90 countries overall involved in the different editions of the assessment, which allows to analyze trends in the performance of students over time. For around 30 countries the trends of the performance of students can be compared across nearly two decades, due to a constant participation in the PISA program. For other countries, results can be compared over at least two assessments. Lebanon has participated in PISA for the first time in 2015 and then in 2018, therefore it is possible to compare scores

between these two PISA cycles. The results of global comparisons show that in the majority of countries, the performance of students remains stable overall, with only few examples of successful improvement and conversely several instances of a decline in the achievements of students.

The data provided by a comparison of the performance of students between countries can be used to identify and enhance policies and practices that support education. PISA not only provides reliable assessment data, but also crucial information related to attitudes, behavior, opinions, teaching practices, school organization, and system-level solutions in a given country. This data can be used to investigate possible associations to explain the educational achievements of students. Nonetheless, it should be stressed that the data acquired through the questionnaires has limitations in terms of the determination of the causal effects of policies and practices. This is because historical, cultural, social, and economic factors cannot be fully accounted for by the analyses, yet they influence the results. Moreover, the policies, practices and reforms that may work in one country might not bring the same results in a different one. Therefore, while the comparison of PISA data can give a valid insight into the education system of different countries, it is important to bear in mind the limitations of this approach, and draw conclusions regarding policy changes carefully and without assuming causal relationships.

Country participation, sampling, response rates, and population

The PISA 2018 assessment saw the participation of 79 countries and economies, including all 36 OECD country members and partners. Overall, around 600 thousand students participated in the 2018 assessment, representing about 32 million 15-year-olds. The first PISA cycle in 2000 involved 42 countries, while in 2015 the number of participating countries rose to 71. Table 1.1 provides the full list of the countries participating in the 2018 PISA assessment. The table identifies the OECD member countries, for which results are summarized in the OECD average, used as an international benchmark in the PISA reports. Several countries from the list did not meet full technical requirements to be taken into consideration in analysis. Moreover, the results for the Netherlands, Portugal, the United States and Hong Kong did not meet the PISA technical standards, but were nonetheless accepted being largely comparable (see more detailed explanations in the OECD, 2019a, Annexes A2, and A4). The results for Vietnam were not fully validated, and they should be therefore interpreted with caution, although they were included in the PISA reports nonetheless. Table 1.1 also includes information about the size of the 15-year-olds population represented in the PISA sample, which came mostly from public schools. In case of Lebanon, the structure of sample was slightly different than in majority of economies, which is going to be deeply discussed in the following part. Table 1.1 also highlights whether a country is considered a "benchmark", meaning that the achievements of its students are going to serve as a comparison in the analysis of the results of Lebanese students.

For the country of Lebanon, the number of students is around 54 thousand. The table identifies the middle-sized populous education systems with above 50 thousand and below 200 thousand students, which in this report are compared to Lebanon in selected figures and additional analyses. The educational systems from the Arab World have been also included in the analysis, despite their size. Similar sized education systems face similar challenges in managing complex networks of schools and related institutions, while the larger the system the harder it might be to coordinate reform efforts politically and technically and usually the larger the social and economic inequalities

Table 1.1

OECD States and Partner Countries and Economies Participating in PISA 2018

Country	OECD member	Benchmark country	Population of 15-year-olds (in thousands)	Country	OECD member	Benchmark country	Population of 15-year-olds (in thousands)
Albania	no	no	28	Luxembourg	yes	no	5
Argentina	no	no	566	Macao	no	no	4
Australia	yes	no	258	Malaysia	no	no	389
Austria	yes	yes	75	Malta	no	no	4
Belgium	yes	yes	118	Mexico	yes	no	1,481
Bosnia and Herzegovina	no	no	29	Moldova	no	no	28
Brazil	no	no	2,037	Montenegro	no	no	7
Brunei Darussalam	no	no	7	Morocco	no	yes	386
Bulgaria	no	no	48	Netherlands	yes	no	190
Belarus	no	yes	78	New Zealand	yes	yes	53
Canada	yes	no	335	Norway	yes	yes	56
Chile	yes	no	214	Panama	no	no	39
Chinese Taipei	no	no	227	Peru	no	no	425
Colombia	yes	no	530	Philippines	no	no	1,401
Costa Rica	no	no	45	Poland	yes	no	319
Croatia	no	no	35	Portugal	yes	yes	99
Czech Republic	yes	yes	88	Qatar	no	yes	15
Denmark	yes	yes	60	Romania	no	yes	148
Dominican Republic	no	yes	140	Russian Federation	no	no	1,257
Estonia	yes	no	11	Saudi Arabia	no	yes	354
Finland	yes	yes	56	Serbia	no	yes	62
France	yes	no	756	Singapore	no	no	44
Georgia	no	no	38	Slovak Republic	yes	no	44
Germany	yes	no	735	Vietnam	no	no	926
Greece	yes	yes	95	Slovenia	yes	no	17
Hong Kong	no	yes	51	Spain	yes	no	417
Hungary	yes	yes	87	Sweden	yes	yes	93
Iceland	yes	no	4	Switzerland	yes	yes	72
Indonesia	no	no	3,769	Thailand	no	no	576

Country	OECD member	Benchmark country	Population of 15-year-olds (in thousands)	Country	OECD member	Benchmark country	Population of 15-year-olds (in thousands)
Ireland	yes	yes	60	United Arab Emirates	no	yes	54
Italy	yes	no	521	Turkey	yes	yes	885
Kosovo	no	no	26	Ukraine	no	no	305
Japan	yes	no	1,079	North Macedonia	no	no	18
Kazakhstan	no	no	212	United Kingdom	yes	no	597
Jordan	no	yes	115	United States	yes	no	3,559
Korea	yes	no	456	Uruguay	no	no	40
Lebanon	no	yes	54	B-S-J-Z (China)	no	no	992
Latvia	yes	no	16				
Lithuania	yes	no	24				

Note: Population size is estimated as a sum of final student survey weights from the PISA 2018 microdata.

As noted previously, the students sampled by PISA are aged between 15 years and 3 months and 16 years and 2 months. PISA requires students to be at least in 7th grade or to have completed at least six years of formal schooling. Students from any type of institution that provides full- or part-time educational programs, which include academic and vocational programs, are accepted to take part in assessment. What differentiates PISA from grade-based studies like TIMSS or PIRLS is the relevance given to the age factor, so that students of a similar age that are in different grades or even school levels can take part in the assessment.

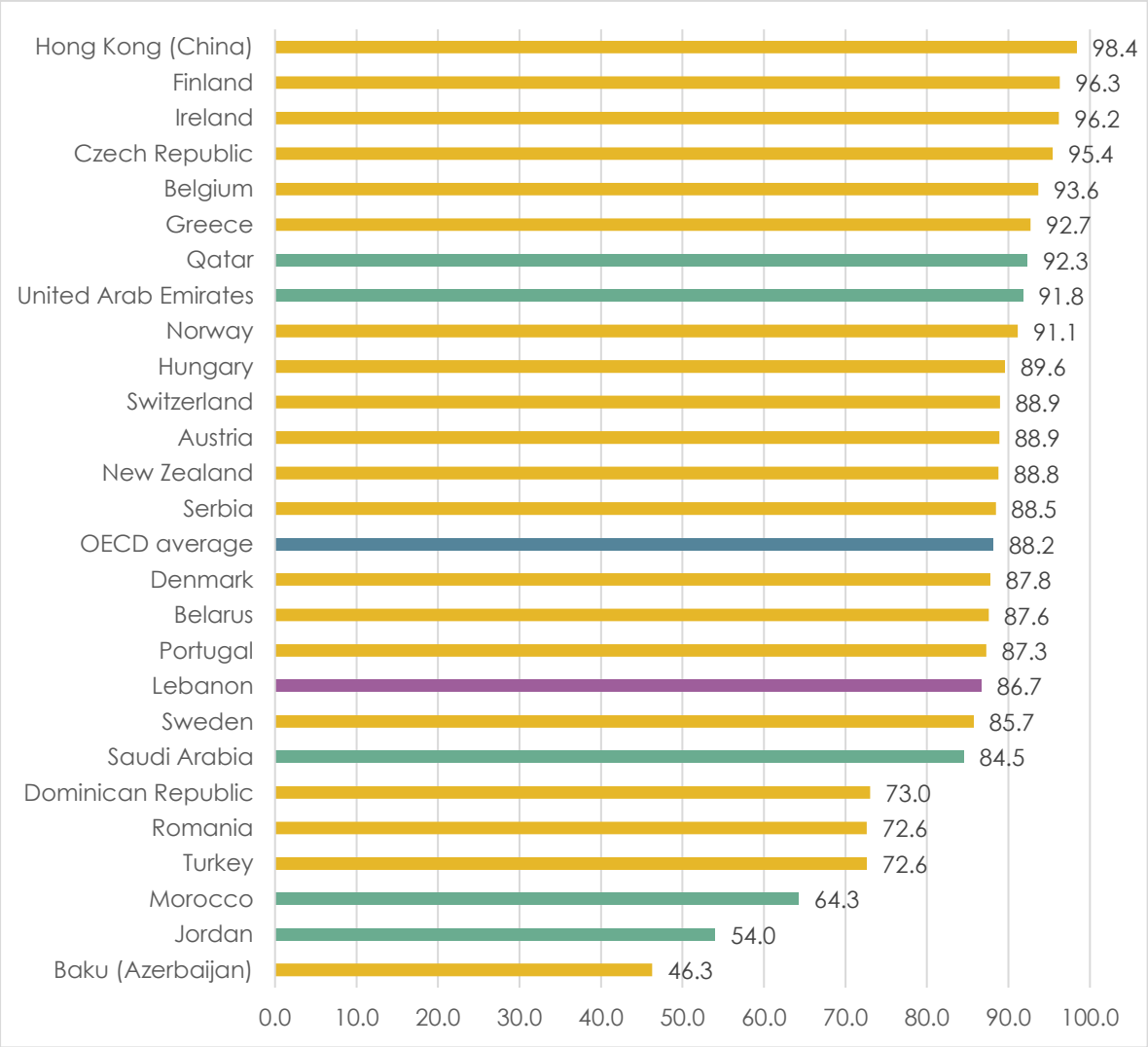
In most of the countries participating in PISA 2018, close to 100% of 15-year-olds are in schools or training. However, some students with disabilities, as well as those with language difficulties were excluded from taking part in the assessment (see below); moreover, some sampled students did not show up on the day when the assessment took place. The coverage of the full population of 15-year-olds varies between countries, since in some countries many 15-year-olds are not enrolled in any educational institution, which should be taken into account when analyzing PISA results.

Figure 1.1 compares the percentage of 15-year-olds covered in the PISA study. In most countries including Lebanon, the coverage rate was above 80%, with the highest rate being observed in Germany, although it should be noted that public

schools were overrepresented in the covered sample. In a few countries the coverage rate is less than 66%, which indicates that one-third or more of 15-year-olds are not participating in PISA and that the results do not properly reflect the competencies of all the 15-year-olds. Some of the lowest coverage rates are found in Jordan, Colombia, Morocco, Brazil, and Mexico. In Jordan, for instance, the PISA sample covers nearly all the 15-year-olds who are enrolled in schools, but it does not represent the competencies of the of 15-year-olds who are not, a figure which makes up almost half of the population.

Figure 1.1 [2]

The Coverage Rate of the 15-Year-Old Population Across PISA 2018 Participants



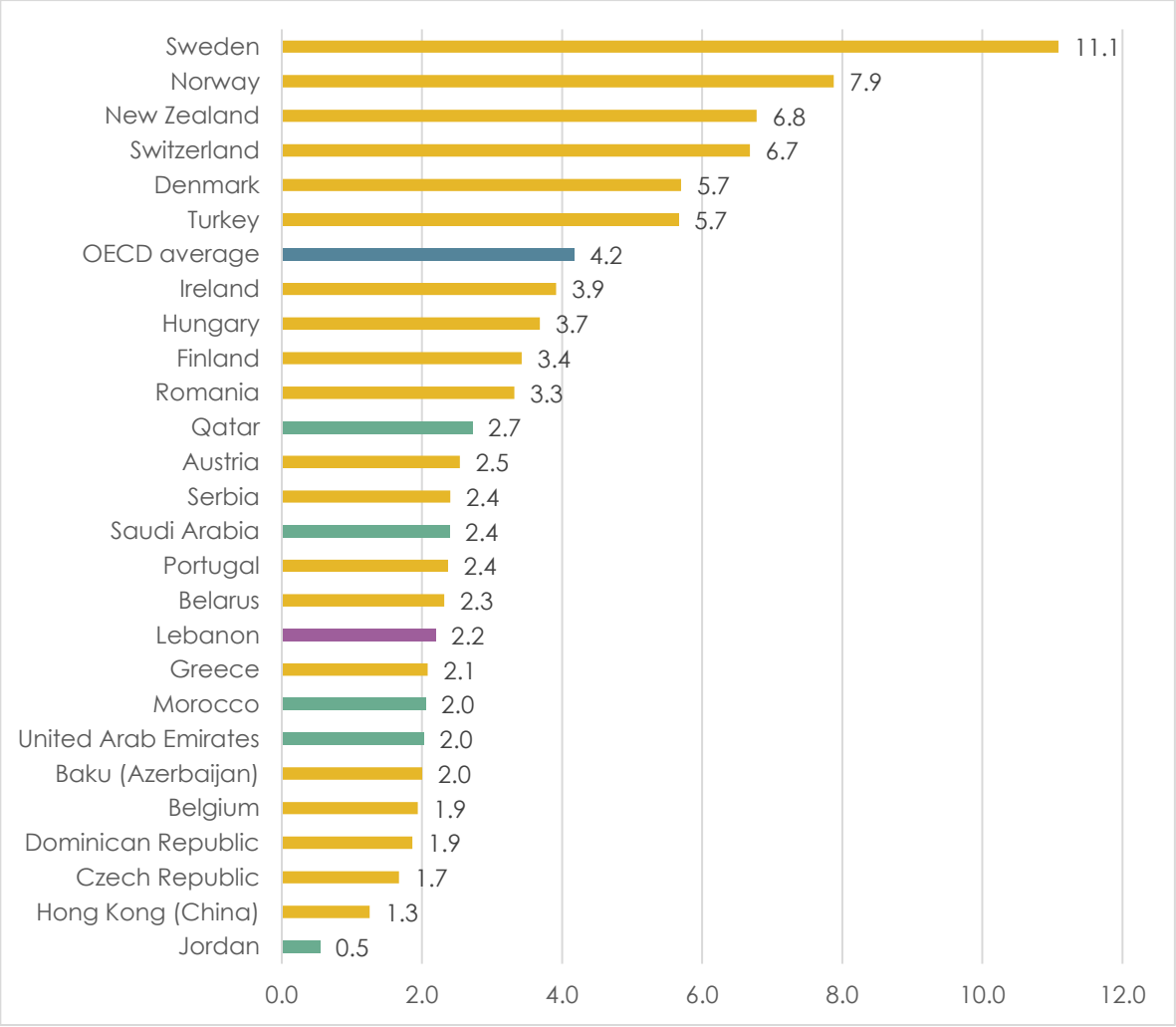
Source: OECD, PISA 2018 Database, Table I.A2.1.

[2] Countries marked with yellow, represent the Arab World

To limit biases on the results, the exclusion rate within a country should be below 5%. In the case of a higher exclusion rate, reliable evidence has to be provided to prove that the exclusions are substantiated and that the results are still comparable with other countries. Some valid reasons for this are the exclusion of schools and students in remote areas and those where the majority of students are disabled or have insufficient proficiency in the language of the assessment. In accordance with the requirements set by the OECD, the overall exclusion rate in most countries remained below 5%.

Figure 1.2

Overall Exclusion Rate - Percentage of the National Desired Target Population (15-Year-Olds Enrolled in School in Grade 7 or Above) Excluded from the PISA Sample Through Either School-Level or in-School Exclusions



Source: Table A1.1 and Table I.A2.1 in OECD, 2019.

PISA uses a complex sampling design with schools as the primary sampling units, and a random sample of students from each individual school. Every school, depending on its level, has to meet a minimum response rate. Generally, the OECD standards require a minimum of 85% response rate. In several countries, the initial school-level response rates were very low and did not meet the minimum even after the replacements of schools. For instance, in Hong Kong the initial response rates were below 75%, meaning that at least one school out of four refused to participate in the PISA assessment. After the replacements, the response rates was 79% in Hong Kong.

At the same time, the minimum response rate for students is 80%. In Portugal, the student-level response rate was 76%, while in Hong Kong, the student-level response rates after school replacements were 85%. Moreover, in New Zealand the student-level response rates were below 85%. After an inspection of the data by the OECD, the decision was made that for these countries the results can be accepted as largely comparable.

Testing mode, questionnaires, sampling, and implementation of PISA in Lebanon

Since 2015, almost all participating countries have administered PISA via computer, transforming PISA into a computer-based assessment, and new items have been developed for computer-based assessment only. Nevertheless, in some countries in PISA 2018 paper-based assessments were administered, similarly to previous cycles. The paper-based form was used in Lebanon, Argentina, Jordan, Saudi Arabia, the Republic of Moldova, the Republic of North Macedonia, Romania, Ukraine, and Vietnam. Paper-based assessments measured student performance with 30 pencil-and-paper forms containing trend items in the three core PISA subjects (reading, mathematics, science). Items in paper-based forms were based on the pre-2018 frameworks and did not include any items based on the new 2018 framework. In the 2018 computer-based assessment, each student took a two-hour test, which was based on a multi-stage adaptive approach. The tests require students to respond to multiple-choice questions as well as open answers. Students were assigned blocks of items of various difficulty, depending on their performance in earlier stages. The OECD PISA report (OECD, 2019a) and the PISA Technical Report (OECD, 2020d) provide additional details on both modes of assessments. Adaptive testing is possible on a computer-based platform and can improve accuracy and fairness in testing.

In all the countries participating in PISA 2018, after completing the cognitive test, participating students answered a questionnaire on their background including their learning habits, their motivation, and family. Both the raw answers and the composite indices are available in PISA databases and are used in this report to provide additional insights into student characteristics, attitudes, learning, instruction, behavior, opinions, and to compare schools with different characteristics. The PISA 2018 Assessment and Analytical Framework (OECD, 2019d) provides a discussion of the research underlying the selection of constructs and questionnaire items[3].

The implementation of the PISA assessment in Lebanon was led by the Center of Educational Research and Development, which was responsible for administering the tests and questionnaires and for providing survey documentation and checking quality standards. In 2018, 320 schools were randomly selected to participate in the

[3] The questionnaires are available on the PISA website: www.oecd.org/pisa.

survey. In the first step, 302 schools responded, and after replacements, 313 schools participated in the survey, 51.6% of which private, with 5,614 participating students. The initial response rate was 94%, increasing to almost 98% after replacements. The exclusion and response rates at the student level both met the OECD standards, since the exclusion rate in Lebanon was 2.19% and the final student-level response rate was 91%.

In Lebanon, the education system strongly relies on the private sector. Many data sources provide different information about the enrolment of Lebanese students in private schools. According to World Bank, in 2018 around 72% of primary school students and 59% of secondary school students were enrolled in private schools. In the BankMed report (2014) it was mentioned that 54% of students are enrolled in fee-paying private schools and another 13% attend free private schools. The PISA Lebanese sample consisted of 48.4% of students attending public, government-dependent schools, 31.2% government dependent private schools, and 20.4% attending private government-independent schools. In such circumstances, it is difficult to establish the share of students attending public schools in Lebanon. Nevertheless, the data confirms that the Lebanese system is highly dependent on the private sector. Since the PISA sample does not match the data provided by other actors, the results showed in this analysis need to be interpreted with caution.

In Lebanon, three main school cycles are found, which are the pre-school, the basic stage, and the secondary stage. Pre-school begins at the age of 4, while basic education begins at 6 and continues until the age of 14. Basic education is divided in two levels, which are the elementary and the intermediate level. Afterwards, secondary education is undertaken until the age of 18, at which a certificate allowing access to tertiary education is awarded. In Lebanon, two thirds of students attend school in a private institution. Moreover, schools teach students three different languages (Arabic as the first language, French and/or English as second languages), with mathematics and science being taught in French or English in the majority of schools, although some private schools teach them in Arabic at the elementary level.

Students who participated in PISA 2018 in Lebanon were all born in 2002. At the time of the assessment, their age ranged from 15 years and 4 months to 16 years and 3 months. The majority of students in Lebanon were 10th graders, mostly studying in public schools. As mentioned above, majority of data sources revealed that around

60-70% of Lebanese students are enrolled in private schools. However, as there are also students in this age bracket in lower and higher grades, some students from grades 7 to 11 were also included to assure the representativeness of the PISA sample to the population of 15-year-olds. Table 1.2 provides the number of students from different grades.

Table 1.2

Basic Statistics for the PISA 2018 Sample in Lebanon

Category	Values	Percentage of represented students in the target population
Grade	7	5.3%
	8	8.5%
	9	16.3%
	10	58.2%
	11	11.7%
	12	0.1%

Source: own calculations from the PISA 2018 microdata.

The samples collected in the different regions of the country can also provide a good representation of 15-year-old students. However, in PISA no special arrangements are made in terms of survey weight adjustments for country regions unless larger samples are collected. For countries that collected larger samples within each country region, the OECD publishes the results as "adjudicated regions", and these results are fully representative to the local populations of 15-year-olds. The results are not additionally adjusted to assure full representativeness to the local populations, but they provide a sound basis for insights about the differences in the performances and attitudes of students. The samples are also smaller than for the whole country, so results are less precise, and this should be considered when making comparisons between different parts of the country.

Student effort and motivation to take the PISA assessment

PISA is a low-stakes assessment, since students nor teachers get to know the results, and there are no consequences for students or teachers who can also refuse to participate. Students can also leave blank responses or fill out tests and questionnaires randomly. As the procedures in all the countries need to be identical to assure full comparability, countries cannot provide additional incentives to students or schools to encourage their participation or to increase motivation to perform well on the test. Nonetheless, countries can and do provide special classes to train students to meet the PISA requirements for the participation in the assessment.

Previous research has revealed that changing the motivations of students to participate and to perform well in assessments can influence their outcomes (e.g., Wise and DeMars, 2005). In these cases, researchers were able to demonstrate that providing incentives to students improves their performance. Thus, low-stakes assessments in which these incentives are not present might provide a biased picture of the achievements of students. This is the rationale behind the awareness campaigns about PISA that some countries roll out in order to improve the results of their students.

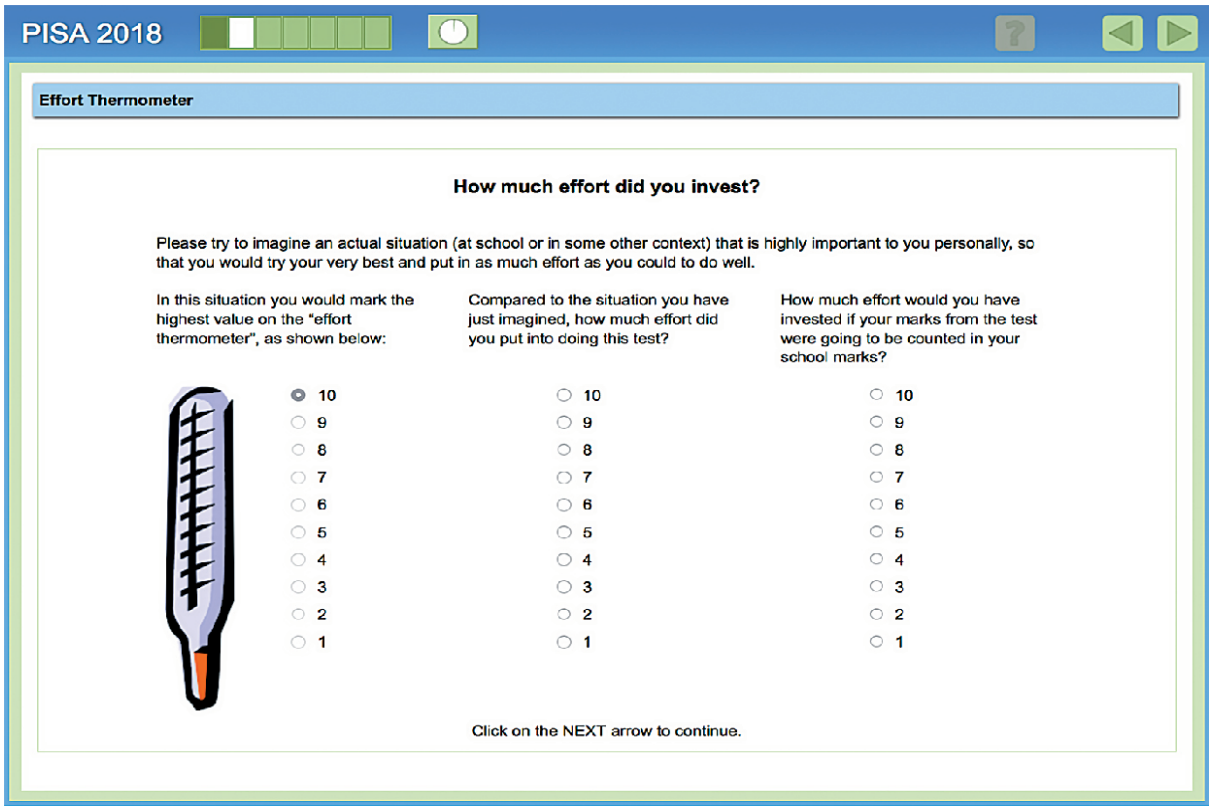
Moreover, these effects might vary across countries. For example, research in Germany demonstrated that there is no difference in student performance in low-stakes assessments with or without additional incentives (Baumert and Demmrich, 2001). A recent study further showed that monetary incentives on a test like PISA led to better student performances in the United States, while no substantial effect was observed in China (Gneezy et al., 2019). This research evidence is summarized in the OECD PISA report as showing that "*differences in countries' and economies' mean scores in PISA may reflect differences not only in what students know and can do but also in their motivation to do their best. Put differently, PISA does not measure students' maximum potential, but what students actually do, in situations where their individual performance is monitored only as part of their group's performance" (OECD,* 2019a, p. 198).

To measure student motivation to undertake the PISA test, participants were asked to self-evaluate their effort using the "PISA thermometer", on a scale from 1 to 10. The exact question from the computer-based assessment is presented below, and students in Lebanon answered a similar question in the paper-based version. Students

were first asked to compare the PISA assessment to a situation that is highly important to them personally and would require the highest effort. In a second question, students were asked how much effort they would invest in the test if results were counted in their school marks.

Exhibit 1.1

PISA 2018 Test-Effort Thermometer



On average, students responded below the maximum of 10 points, with an average of 7.6, meaning that an average student did not put her maximum effort into the PISA assessment. Moreover, there were differences between students within countries and in the average self-reported efforts across countries. These results can be checked when comparing countries' performance to see if the self-reported test effort does not differ too much between the compared countries. These measures can also be used when comparing groups of students. The results for Lebanon also suggest that students may not have put maximum effort into the test, as their average effort score was the lowest among all countries and economies participating in the assessment. Thus, at least according to student self-reports, PISA assessment results in Lebanon might not reflect the maximum potential of the participating students. It is worth noting that the effort measures should be analyzed with caution as they are

subjective, and real student effort might be different. On average, students in countries with higher performance reported lower test effort on the first measure and slightly higher on the second measure. The OECD report provides additional measures to see how much effort students put into the PISA test, but mainly for countries that participated in the computer-based assessments.

How to interpret the PISA results?

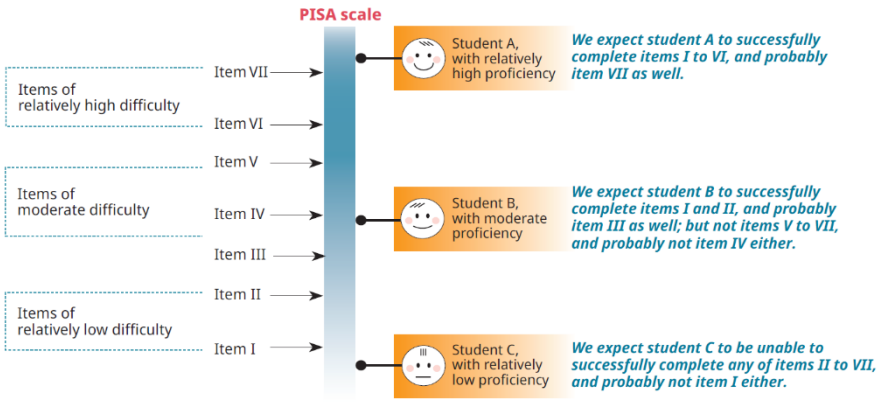
Based on the student responses to test items, PISA scores are estimated using a complex IRT (item-response theory) psychometric modelling. Advanced statistical methods that take into account sampling and measurement errors are used to estimate results and their precision.

Box 1.1

From Test Questions to PISA Scores

PISA reports both the difficulty of questions and the proficiency of test-takers on a single continuous scale, based on item-response theory models. By showing the difficulty of each question on this scale, it is possible to locate the level of proficiency in the subject that the question demands. By showing the proficiency of test-takers on the same scale, it is possible to describe each test-taker's level of skill or literacy by the type of tasks that he or she can perform most of the time correctly.

Estimates of student proficiency are based on the kinds of tasks students are expected to perform successfully, meaning that students are likely to be able to successfully answer questions located at or below the level of difficulty associated with their position on the scale. Conversely, they are unlikely to be able to successfully answer questions above the level of difficulty related to their position on the scale.



Source: OECD PISA 2018 report, page 43.

Student performance in PISA is estimated using responses to a two-hour-long test, with different groups of students answering different questions, from a sample of more than a hundred test items. The complex sampling methodology (briefly described in the previous sections) assures that the sample is representative of the target population. Although the final results are estimated with the highest possible

precision, they are subject to sampling and measurement errors: the former is a result of surveying only a sample of students, while the latter is instead related to the imprecision with which a single test can measure student achievement. These errors are combined into a single measure (the standard error), which is used in the PISA reports to show how precise the final results are and to test result differences for statistical significance (which, in both the OECD reports and in this one, is set at 95%, meaning that using the same methodology, in 95 out of 100 situations the results would be comparable to the ones reported). The measures of perception mentioned above can be used to compare results from Lebanon to the OECD average or other countries. The most straightforward way of assessing whether results differ significantly between countries is to check whether confidence intervals overlap. If they do, then it cannot be conclusively said that the results are different with a 95% confidence level It should be noted that the smaller the compared sample, the larger the associated errors, so the results are usually statistically similar for small groups of students.

Box 1.2

Interpreting Differences in PISA Scores

PISA scores do not have a substantive meaning as they are not physical units, such as metres or grams. Instead, they are set in relation to the variation in results observed across all test participants. There is theoretically no minimum or maximum score in PISA; rather, the results are scaled to fit approximately normal distributions, with means around 500 score points and standard deviations around 100 score points. In statistical terms, a one-point difference on the PISA scale therefore corresponds to an effect size (Cohen's d) of 0.01; and a 10-point difference to an effect size of 0.10.

To help users interpret what students' scores mean in substantive terms, PISA scales are divided into proficiency levels. For example, for PISA 2018, the range of difficulty of reading tasks is represented by eight levels of reading literacy: the simplest tasks in the assessment correspond to Level 1c; Levels 1b, 1a, 2, 3, 4, 5 and 6 correspond to increasingly more difficult tasks.

For each proficiency level identified in this way, descriptions were generated to define the kinds of knowledge and skills needed to complete those tasks successfully. Individuals who are proficient within the range of Level 1c are likely to be able to complete Level 1c tasks, but are unlikely to be able to complete tasks at higher levels. Level 6 includes tasks that pose the greatest challenge in terms of the skills needed to complete them successfully. Students with scores in this range are likely to be able to complete tasks located at this level and all the other tasks in the domain in question (see the following chapters for a detailed description of the proficiency levels in reading, mathematics and science).

Each proficiency level corresponds to a range of about 80 score points. Hence, score-point differences of 80 points can be interpreted as the difference in described skills and knowledge between successive proficiency levels.

Source: OECD PISA report, page 43.

The previous PISA reports used a score-point difference equivalent to "years of schooling", which was estimated to be around 30 score points on the PISA scale. This estimate was based on a multilevel model comparing student performance in different grades, after controlling for background variables. However, evidence from different countries shows that such estimates can vary from 10 to more than 40 points on the PISA scale, and none of them is estimated in a way which can assure a fully causal relationship between schooling and test results. Thus, in the PISA 2018 report this equivalent is no longer used as there are "many difficulties involved in estimating the "typical" progress of a 15-year-old student from one year to the next or from one grade to the next in an international study such as PISA" (OECD, 2019a, p. 44).

Reference to the OECD reports

This report provides a detailed discussion of PISA 2018 results in Lebanon from an international perspective. Additional results and technical details can be found in several PISA reports issued by the OECD. The initial PISA 2018 results have been released in six volumes:

- **Volume I: What Students Know and Can Do** (OECD, 2019a), which provides a detailed examination of student performance in reading, mathematics, and science, and describes how performance has changed over time.
- **Volume II: Where All Students Can Succeed** (OECD, 2019b), which examines gender differences in student performance, the link between socioeconomic status and immigrant background of students on the one hand, and their performance and other outcomes on the other, plus the relationship between all of these variables and the well-being of students. Trends in these indicators over time are examined when comparable data are available.
- **Volume III: What School Life Means for Students' Lives** (OECD, 2019c), which focuses on the physical and emotional health of students, the role of teachers and parents in shaping the school climate, and the social life at school. The volume also examines indicators of student well-being and how these are related to school climate.
- **Volume IV: Are Students Smart about Money?** (OECD, 2020a), which examines the understanding of money-related matters of students in the 21 countries and economies that participated in this optional assessment. The volume explores how the financial literacy of 15-year-old students is associated with their competencies in reading and mathematics, with their socioeconomic status, and with their previous experiences with money. It also offers an overview of financial education in schools in the participating countries and economies and provides case studies.
- **Volume V: Effective Policies, Successful Schools** (OECD, 2020b), which analyses schools, and school systems and their relationship with educational outcomes more generally. The volume covers school governance, selection and grouping of students, and the human, financial, educational, and temporal resources allocated to teaching and learning. Trends in these indicators are examined when comparable data are available.

- **Volume VI: Are Students Ready to Thrive in Global Societies?** (OECD, 2020c), which examines the ability of students to consider local, global, and intercultural issues, understand and appreciate different perspectives and worldviews, interact respectfully with others, and take responsible action towards sustainability and collective well-being. It does so through both an assessment completed by students and questionnaires completed by students and school principals.

The frameworks for assessing reading, mathematics, science, financial literacy, and global competence in 2018 are described in the PISA 2018 Assessment and Analytical Framework (OECD, 2019d). Technical annexes at the end of the PISA 2018 report (OECD, 2019a) describe how questionnaire indices were constructed and discuss sampling issues, the quality assurance procedures, and the process followed for developing the assessment instruments. Technical issues are elaborated in greater detail in the PISA 2018 Technical Report (OECD, 2020d).

Chapter 2. Reading performance of students in Lebanon from an international perspective

Overview of the results

In PISA 2018, students from **79** countries and economies completed the reading assessment. In 52 out of 78 countries and economies, the average results were statistically lower than the OECD average. The mean performance of Lebanese 15-year-old students was below the OECD average by 134 points, which is the third-lowest result in reading among all the participating countries. Since the last assessment in 2015, there has been a statistically insignificant improvement in the reading performance in Lebanon. As presented in Exhibit 2.1., only in the Dominican Republic and the Philippines the mean score in the reading assessment was statistically lower than in Lebanon. In comparison to countries from the closest neighborhood of Lebanon, the reading performance of students from Saudi Arabia and Jordan was higher by (up to 50 points for the former), while in Turkey the difference exceeded 110 points. Nonetheless it should also be stressed that in Lebanon, after Arabic, the main language of instruction is French. While English is also taught and therefore the PISA assessment can be administered, it is nonetheless weaker and this may be reflected in the poor results of Lebanese students. Esseili (2014) mentioned that the quality of teaching English is poor in public schools, and also that majority of schools decide to provide French lessons instead of English. As mastery in the language of the assessment is crucial, especially when it comes to reading, Lebanese students might struggle to succeed in reading.

Exhibit 2.1.

List of countries with higher, lower, and similar results to Lebanon. Neighboring middle-eastern education systems are bolded.

Countries with lower average performance	Dominican Republic, Philippines
Countries with similar performance	Morocco, Kosovo
Countries with performance higher by up to 50 score points	Bosnia and Herzegovina, Argentina, Peru, **Saudi Arabia**, Thailand, North Macedonia, Baku (Azerbaijan), Kazakhstan, Georgia, Panama, Indonesia
Countries with higher performance but not above the OECD average	Portugal*, Czech Republic, Netherlands*, Austria, Switzerland, Croatia, Latvia, Russia, Italy, Hungary, Lithuania, Iceland, Belarus, Luxembourg, Ukraine, Turkey, Slovak Republic, Greece, Chile, Malta, Serbia, **United Arab Emirates**, Romania, Uruguay, Costa Rica, Cyprus, Moldova, Montenegro, Mexico, Bulgaria, **Jordan**, Malaysia, Brazil, Colombia, Brunei Darussalam, **Qatar**, Albania
Countries above the OECD average	B-S-J-Z (China), Singapore, Macao (China), Hong Kong (China)*, Estonia, Canada, Finland, Ireland, Korea, Poland, Sweden, New Zealand, United States*, Vietnam**, United Kingdom, Japan, Australia, Chinese Taipei, Denmark, Norway, Germany, Slovenia, Belgium, France

Source: Table A3.1 and Table I.B1.4, OECD, 2019a.

Note: *did not obtain PISA technical standards, **results not fully validated

The best-performing countries and economies in reading were parts of China (the four inland provinces of Beijing, Shanghai, Jiangsu, and Zhejiang, as well as Macao and Hong Kong); other Asian countries like Singapore and Korea; three European countries (Estonia, Finland, and Poland); and Canada. Some of these countries, such as Estonia and Singapore, have relatively small educational systems. In countries such as Estonia, Poland, Singapore, and the Chinese province of Macao, a significant trend of improving students' reading performance was observed compared to past assessments. The reading assessment results may reflect the years of investments in the quality of education in the top-performing countries, and also their efforts in preparing their students for such international assessments via training both teachers and students on how to get higher results.

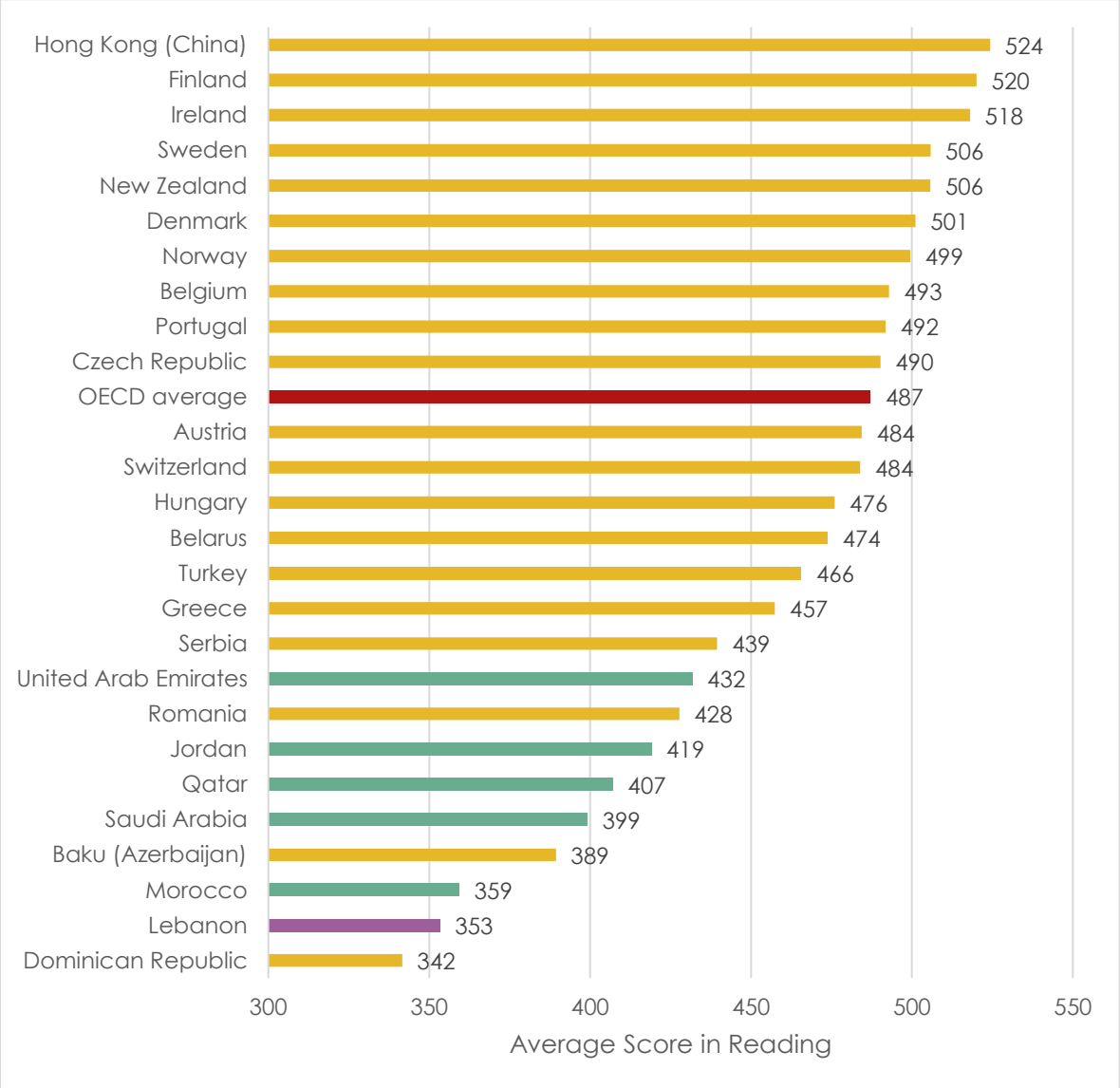
The mean score is a statistical measure that provides information about the performance of students in reading. However, these statistics are highly sensitive to inequalities and achievement distribution. Thus, when analysing differences between and within countries, some additional measures should also be accounted for. A meaningful way to approach the disparities in reading performance is to compare

the percentage of students who have reached scores corresponding to different proficiency levels. Figure 2.2. compares the share of students at all proficiency levels in reading across Lebanon and the OECD average. The second level of proficiency in reading translates into the most elementary competencies in reading which are generally assumed to be established in 15-year-old students

In Lebanon, more than two-third (67.8%) of 15-year-old students did not reach the second proficiency level in reading. Moreover, 6% of these students did not even obtain the lowest proficiency level in reading. In 36 OECD countries, 22.6% of students underperformed in the reading assessment on average. In the second and third levels, almost 28% of Lebanese students are found, while in the OECD countries more than half of the students reached these benchmarks. Only 3.7% of Lebanese students who participated in the PISA test reached the fourth level of proficiency in reading, while in the OECD countries almost 1 out of 5 students did.

Figure 2.1

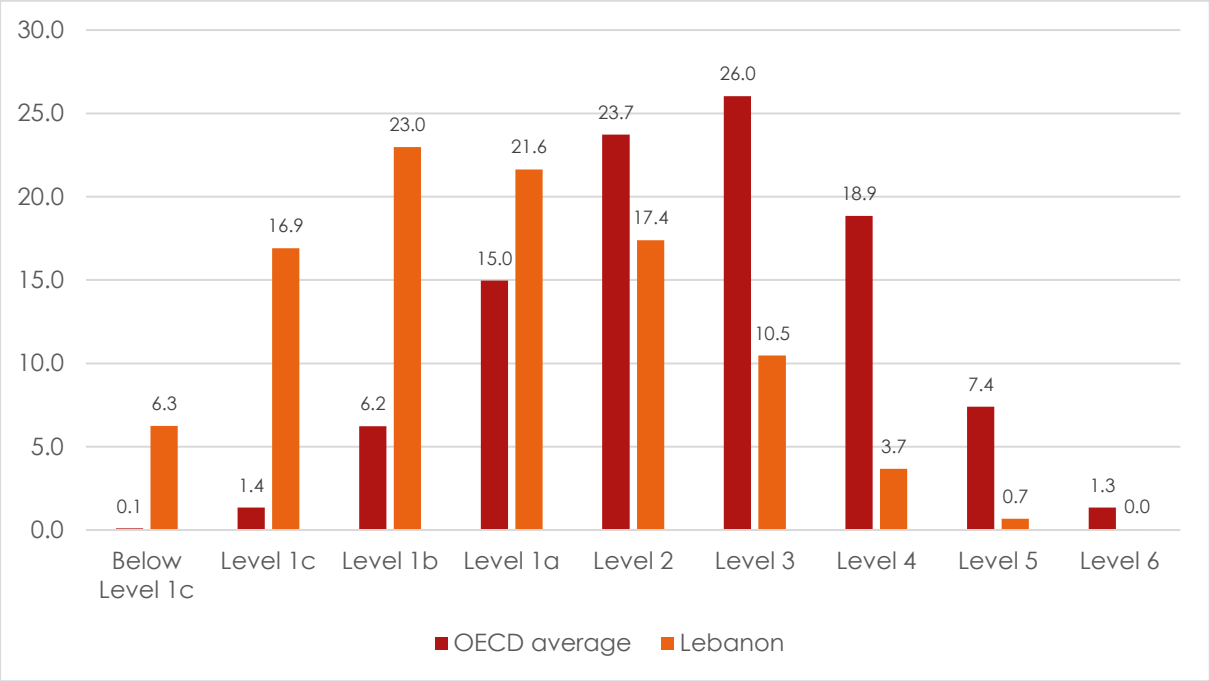
Comparison of average reading scores in Lebanon and selected countries



Source: Table A3.1 and Table I.B1.4, OECD, 2019a.

Figure 2.2

Percentage of students at different reading proficiency levels in Lebanon and on average across 36 OECD countries



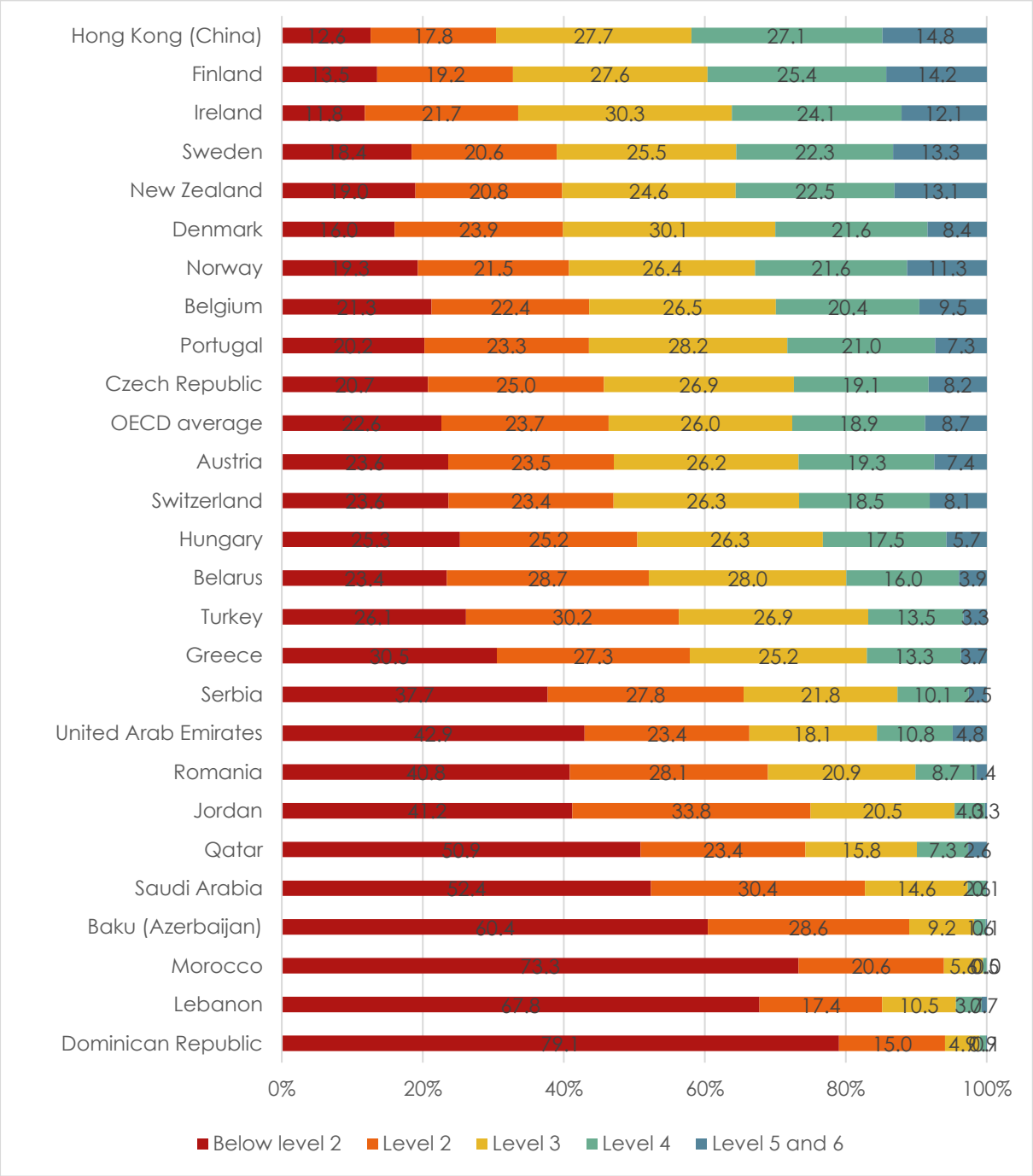
Source: Table A3.2 and Table I.B1.1, OECD, 2019a.

Figure 2.3. presents the share of students at each proficiency level in reading in the countries participating in PISA. The shares of students correspond mainly to the mean scores, as in top achieving countries the smallest share of students did not reach level 2 (i.e. Hong-Kong, Finland), while the among low-achieving countries and economies the largest part of students consists of those who did not reach level 2 (Morocco, Lebanon).

Among the countries in the region, in Jordan and Saudi Arabia around 40-50% of students did not reach the second level of proficiency in reading. In other countries, more students reached a higher level of proficiency in reading. Among countries that delivered the assessment in the paper-based form, in Lebanon, North Macedonia, Argentina, and Saudi Arabia, the share of students that did not reach the second level exceeded 50%, while in Ukraine less than 1 out of 4 students did not reach the second PISA benchmark in reading.

Figure 2.3

Reading proficiency level distribution across selected countries



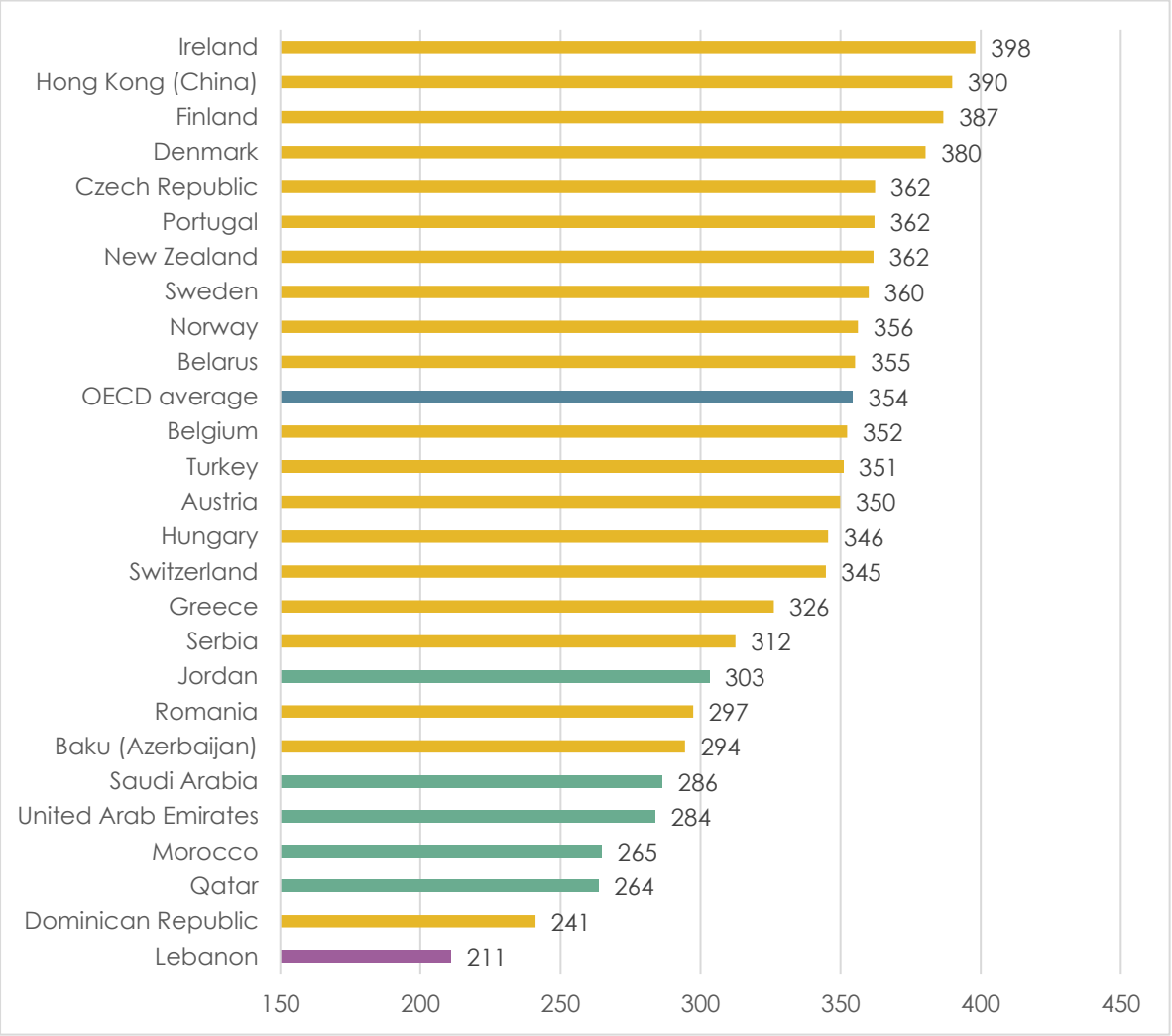
Source: Table A3.2 and Table I.B1.1, OECD, 2019a.

Another approach to distinguish the properties of the results in Lebanon is to determine the inequalities between low-achieving (10th percentile) and high-achieving students (90th percentile). By comparing these two values, the range of the inequalities can be determined and compared between the countries. Figure 2.4

focuses on the 10th percentile of the results in the reading assessment in Lebanon and other selected countries. In the countries where students obtained the highest average results in reading, such as Finland and Hong-Kong, the lowest-achieving students received the highest reading results compared to other participating countries and economies. In Lebanon, the lowest-achieving students scored the lowest result in reading. On average, the score of Lebanese lowest-achieving students was lower by 143 points than the OECD average. Compared to other countries at the bottom of the ranking, such as the Dominican Republic and Qatar, the performance of Lebanese 15-year-old students was still lower by more than 30 points. Since the 10th percentile of scores in reading of Lebanese students is in the Level 1c range, this implies that the lowest-achieving students are not able to fully understand even the literal meaning of a short sentence. The reading experiences of these students are often supported by an explicit pointing at the information and pictures, and repetition.

Figure 2.4

Comparison of performance of low-achieving students in Lebanon and the selected countries (10th percentile of reading performance distribution in each country)



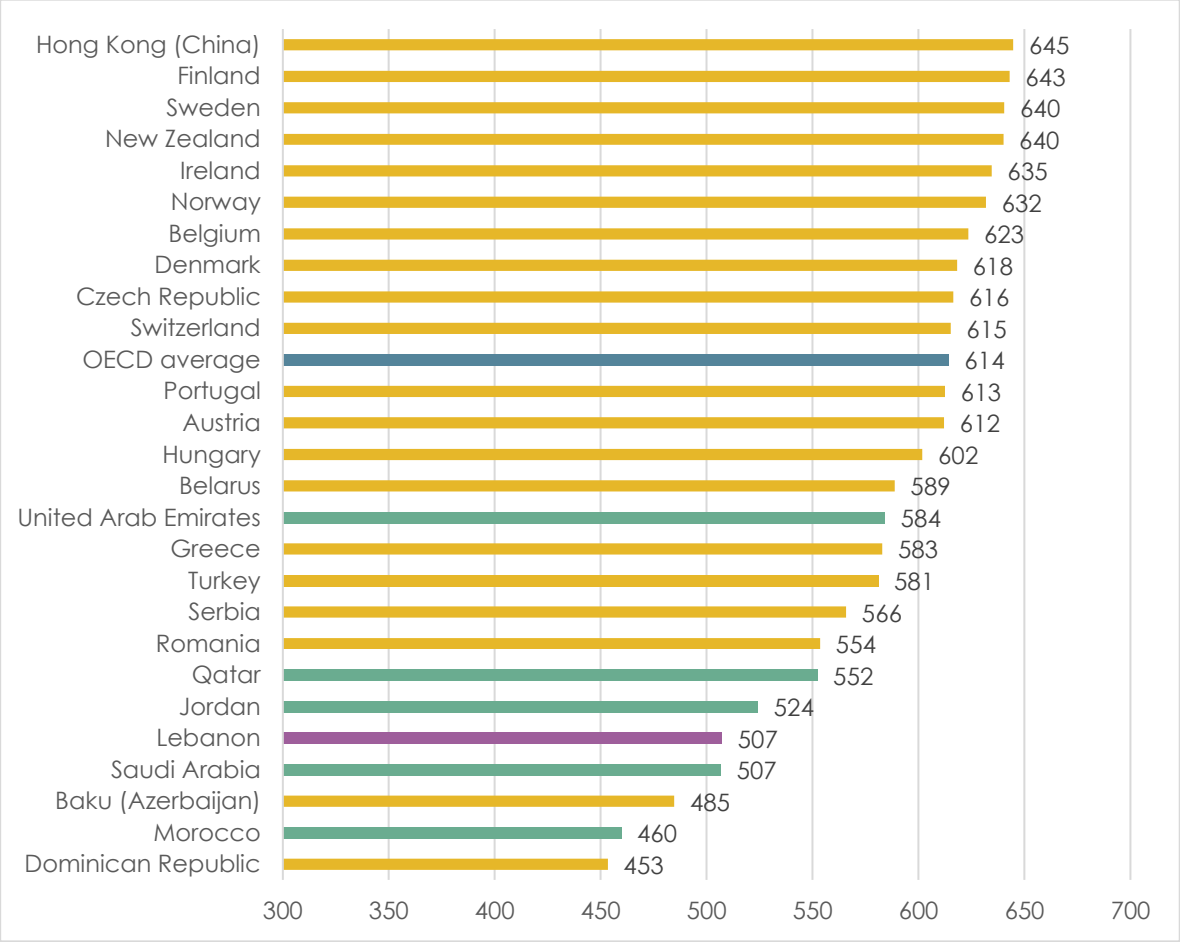
Source: Table A3.3. Own calculations from the PISA database.

Similarly, figure 2.5. compares the 90th percentile of the average results in reading across Lebanon and other selected countries. Again, similarly to the 10th percentile, the students' highest performance in reading was observed among countries that were placed at the top of the average score ranking such as Hong-Kong and Finland. Again, when looking at the 10th percentile ranking, there are no vast differences between the best-performing. In Lebanon, 15-year-old best students scored 507 points in reading. This result is lower by 107 points than the average OECD 90th percentile. The reading performance of the highest-achieving students in Lebanon is similar to the performance of the mean students on the OECD average.

The participating best students from Lebanon reached level 3 in proficiency on average, which means that these students can recognize only some relationships between information given in the text, and a proper understanding of literary nuances and the retrieval of relevant information from unfamiliar texts are still out of reach for Lebanese highest-achieving students.

Figure 2.5

Comparison of performance of high-achieving students in Lebanon and the selected countries (90th percentile)



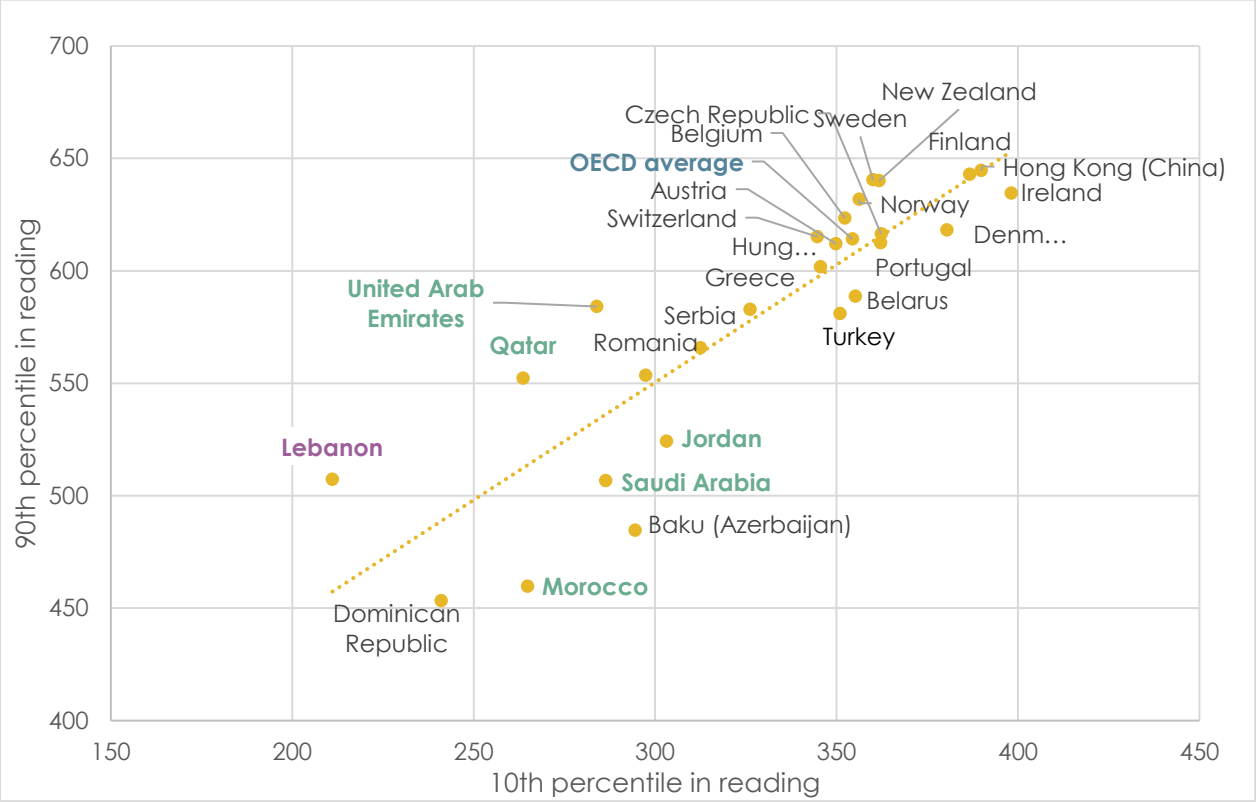
Source: Table A3.3. Own calculations from the PISA database.

Figure 2.6. summarizes the achievements of low and high-performing students (the 10th and 90th percentile of the results) in reading in Lebanon and other selected countries. On average, there is a natural positive relationship between the scores of the highest-achieving and low-achieving in reading. In the countries above the denoted trendline, the highest achieving students scored relatively more points, which

means that these are outliers who are the main drivers of the country's mean score. Below the trendline, the highest achieving students scored less than expected. In some countries, low-achieving and high-achieving students could be found at the top, such as in Hong-Kong and Finland. Countries such as Qatar, the United Arab Emirates and Sweden are similar, since the performance of the best students was higher than in the general trend. On the contrary, in Saudi Arabia, Mexico, Croatia, and Ireland, the performance of high-achieving students was relatively lower.

Figure 2.6

The relative performance of low- and high-achieving students (10th and 90th percentiles of reading performance)



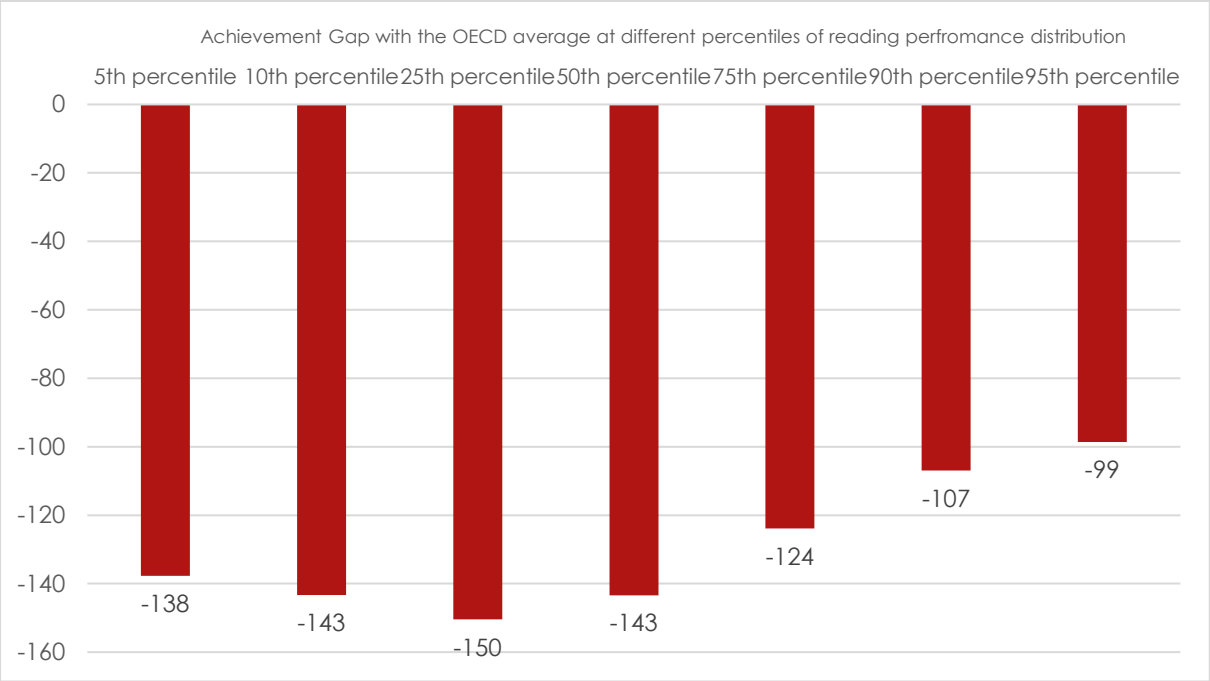
Source: Table A3.3. Own calculations from the PISA database

In Lebanon, high achieving students overachieved, since they scored around 50 points more than the general trend line. On the other hand, in Morocco, which is a country where the average score in reading was close to the one of Lebanese students, high achieving students scored less than expected. **This means that the mean achievement in reading is low mainly due to the underperformance of low-performing students.**

A more detailed analysis of the distribution of the results in Lebanon is shown in Figure 2.7., which presents the achievements gaps between students at 5th, 10th, 25th, 50th, 75th, 90th, and 95th percentiles between Lebanon and the OECD average. At each percentile, the score of Lebanese students was lower than the OECD percentile. The largest differences between Lebanon and the OECD countries can be found at the 25th percentile. The lowest difference is lower than 100 points and can be observed at the 95th percentile.

Figure 2.7

Comparison of performance of Lebanese students across the reading score distribution with the performance across the OECD countries



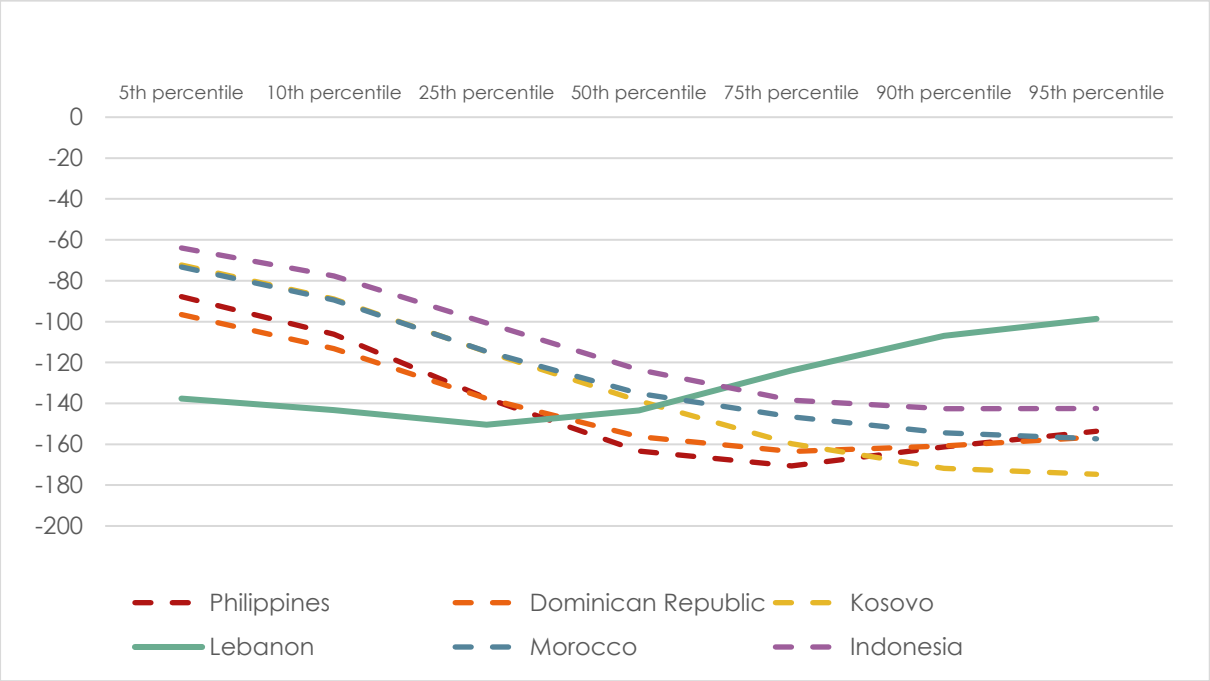
Source: Table A3.3. Own calculations from the PISA database.

Figure 2.8. compares the gaps between countries performing similar to Lebanon and the OECD average concerning the low-, average-, and high-achievers. In these countries, there are high differences between high-achievers in comparison to the OECD average. In Lebanon, the gap is high among low- and average- achievers, but relatively low among high-achievers. Thus, even though the educational inequalities should be investigated in a policy and national context, it can be said that the Lebanese educational system is highly affected by the inequalities and performance

of the low-achievers: this can be due to the fact that low-achievers make-up the majority of the student population.

Figure 2.8

The gap between the OECD average and reading performance at different percentiles for selected countries with similar average performance to Lebanon (the more substantial negative value shows a more significant gap against the OECD average)

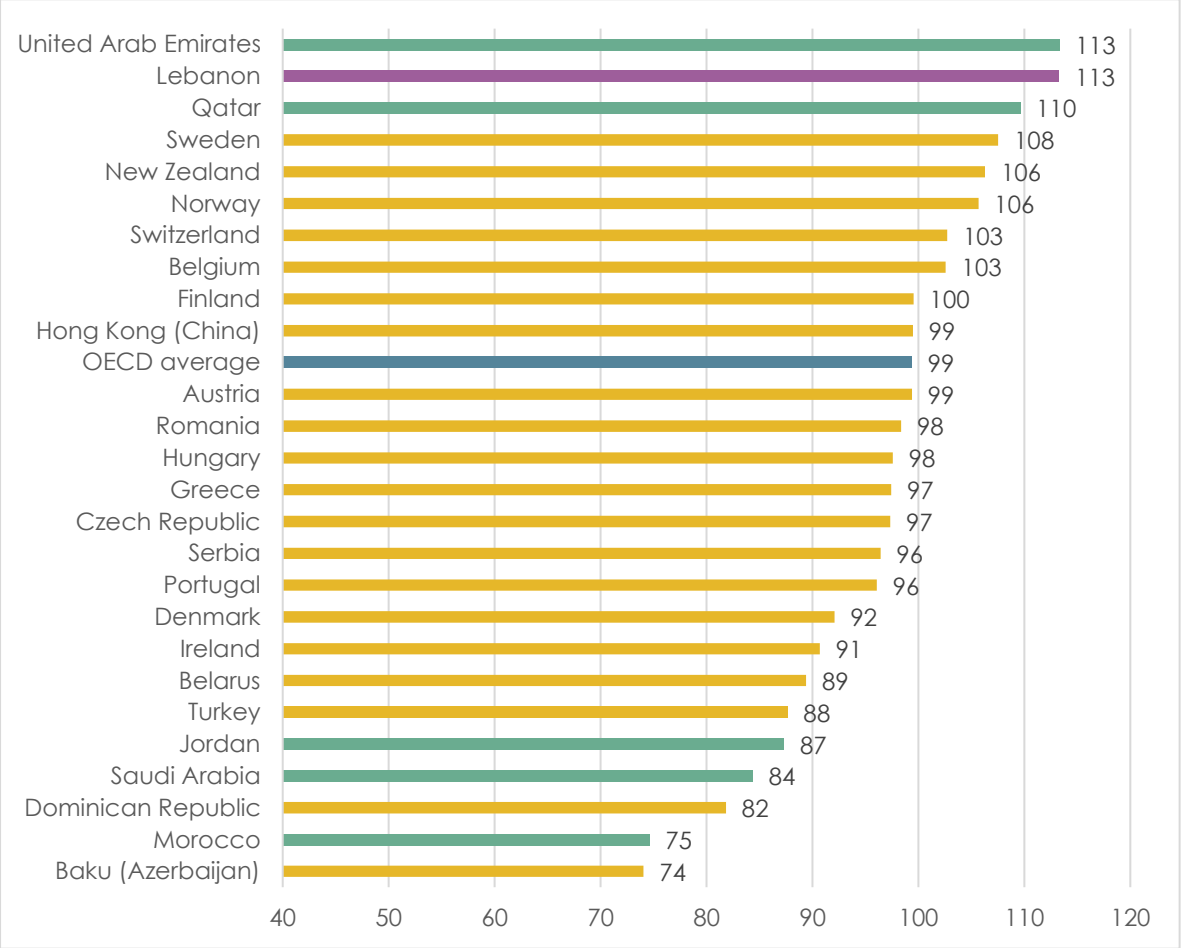


Source: Table A3.3. Own calculations from the PISA database.

Another useful measure which can describe how the results are spread around the mean score is the standard deviation, which can be seen as a measure of the variability between the achievements of students, since the higher the standard deviation, the more heterogenous the results. Figure 2.9. presents this measure in Lebanon and other countries participating in the assessment.

Figure 2.9

Variation (standard deviation) in student performance



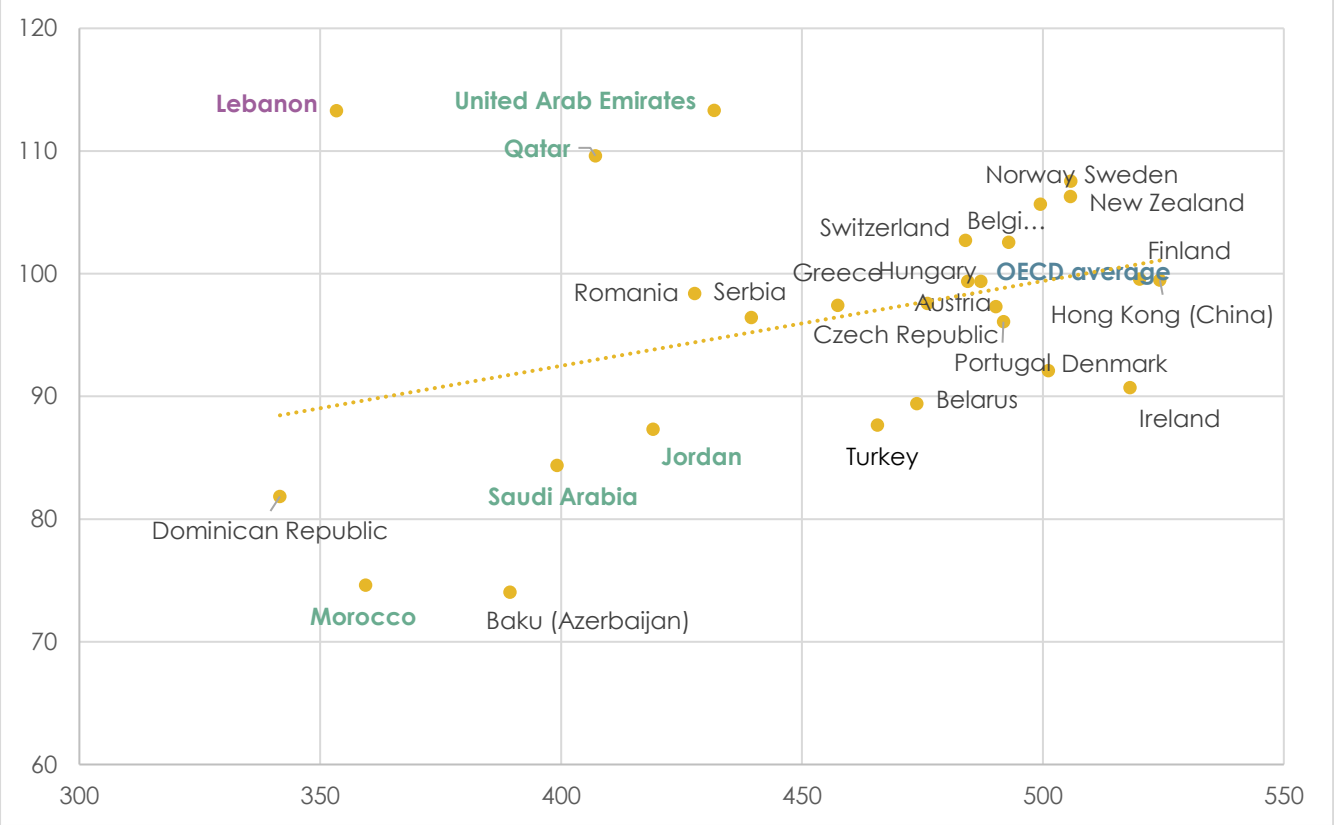
Source: Table A3.3. Own calculations from the PISA database.

In Lebanon and the United Arab Emirates, the standard deviation in reading is the highest among all participating countries, and higher by 14 points than in the OECD average, which can further confirm the existence of inequalities between high and low-achieving students in Lebanon.. As for average-achieving countries and economies, such as Austria, Hungary, Czech Republic and Ireland, the standard deviation was lower than the OECD average. On the other hand, in Morocco and Saudi Arabia, countries whose score in reading was similar to the one in Lebanon, one of the lowest standard deviations can be observed.

Figure 2.10. compares the average score in reading performance against the standard deviation among selected countries and Lebanon. In this model, the standard deviation is explained by the country's or economy's mean score in reading. In Lebanon and United Arab Emirates it is possible to expect large educational inequalities, since the variation of the results is considerably higher than the trendline estimated. The OECD average is almost tangent to the trendline.

Figure 2.10

Variation against average reading



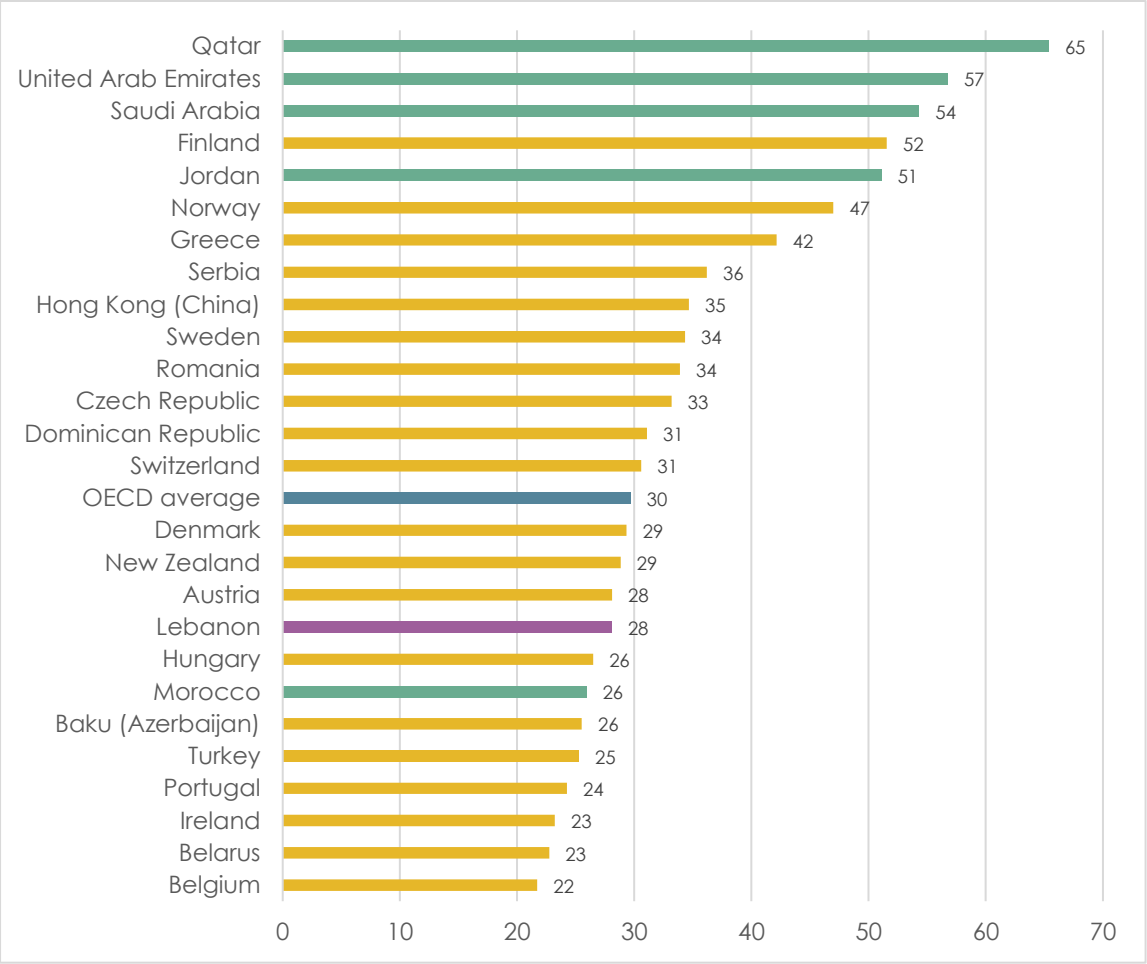
Source: Tables A3.1 and A3.3

Gender gaps in reading achievements

Gender achievement gaps are a well-known phenomenon in educational studies. Since the launch of the large-scale international assessments, girls have shown a better performance in reading, while boys have performed better in mathematics. These disparities are mostly unobservable in adult life, but the process of lowering the gap between men and women is still not well investigated (Borgonovi et al., 2018). Several research studies examined the sources of the inequalities, and noted that intrinsic motivation, reading enjoyment, texts preference, and the omission of the tasks strongly differ between the genders (Twist, 2020). The lack of reading skills might become a challenge for boys in subsequent education cycles. Hence, analyzing the differences between girls and boys in reading might provide useful insights for policy-makers aiming at reducing the gap and the difficulties encountered by students later during their lives.

Figure 2.7

The gender gap in reading achievement (performance advantage of girls over boys)



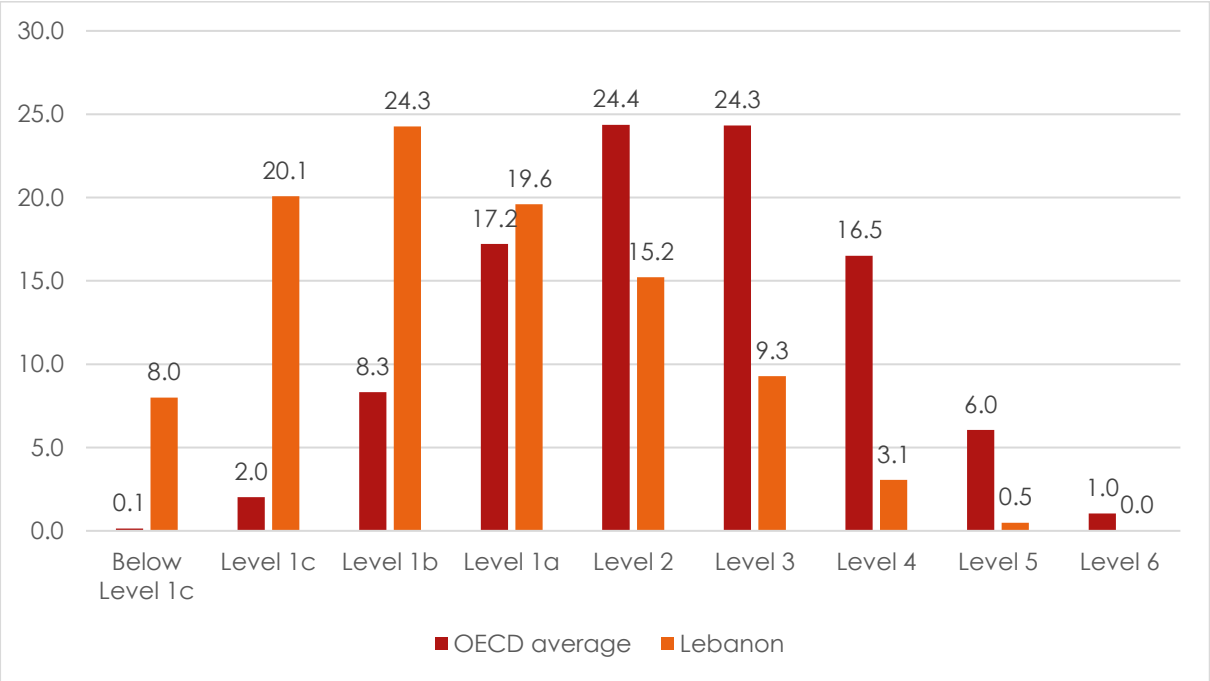
Source: Table A3.4 and Table II.B1.7.1, OECD, 2019c.

Figure 2.11. compares the difference between the scores of girls and boys in reading in Lebanon and selected countries. The largest gender gaps were found in Qatar, United Arab Emirates and Saudi Arabia. In these countries, the performance of boys was lower by more than 60 points than the one of girls. Since these countries are located in a close neighborhood, the gender gap may be connected to shared cultural factors. On the other hand, there were no large differences between boys and girls among the most successful countries and economies in reading, such as Ireland. At the same time, in Hong-Kong the gap was slightly higher than the OECD average. In Lebanon, the difference in reading performance is slightly lower than the average one in the OECD countries. Lebanese girls outperformed boys by 28 points, which though not a huge difference, still translates into 8% of the relative gap between the genders in Lebanon. In comparison to other countries, the reading disparities exceed the OECD average in terms of relative differences.

Figures 2.12 and 2.13 provide a more detailed analysis of the differences between the genders. Figure 2.12. compares the distribution of proficiency levels among boys in reading in Lebanon and the OECD average. Similar to the distribution of all Lebanese students, boys' results are skewed to the right, while the OECD average holds the shape of a normal distribution. Among the proficiency levels below the second level, the share of boys in this area in Lebanon was higher than is observed in the OECD average. At the 5th level of proficiency in reading, the percentage of boys was slightly lower than the Lebanese average, which might suggest that the reading achievements of boys are less heterogeneous. As a consequence, the inequalities between boys might be less significant than in the case of girls, though there is still a wide gap in reading achievements between boys and girls. In the average of the OECD countries, similar patterns were observed in the case of the most advanced levels in reading among boys, which may be a direct consequence of the better performance of girls in reading assessments.

Figure 2.8

Reading proficiency level distribution among boys in Lebanon compared to the OECD average distribution for boys

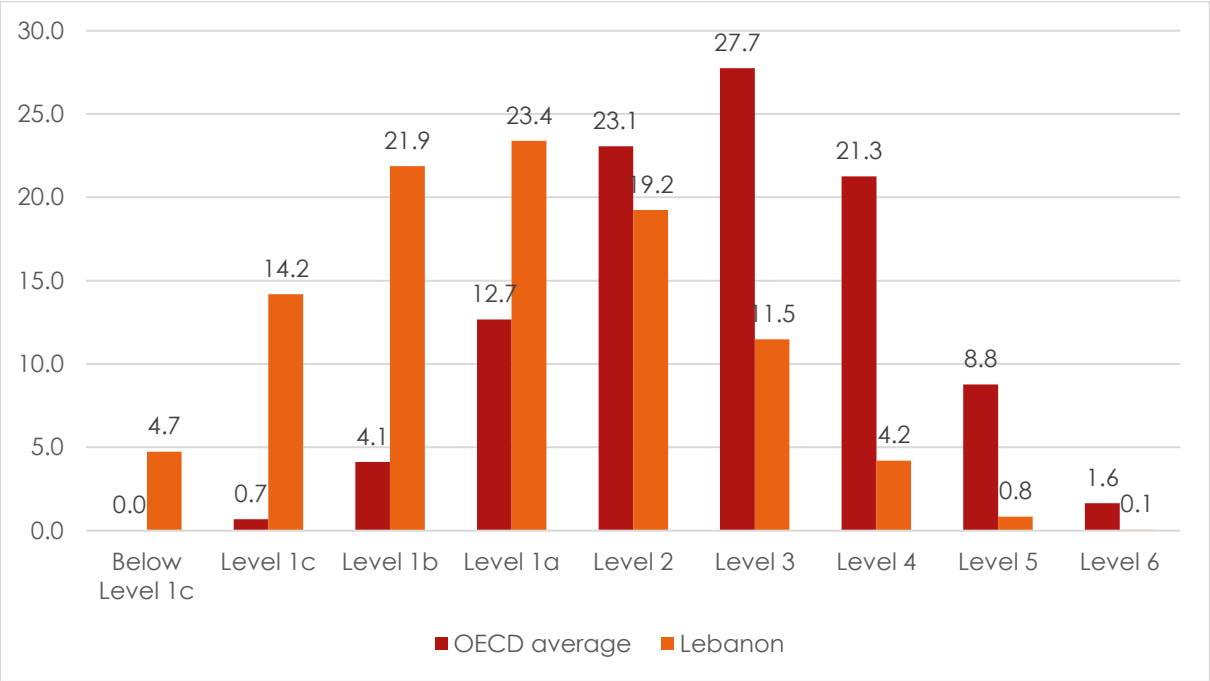


Source: Table A3.5 and Table II.B1.7.2, OECD, 2019c

Figure 2.13 compares the reading proficiency levels of girls in Lebanon, in comparison to the OECD average. Considerably more girls reached more advanced levels of reading proficiency: below level two there were fewer girls than boys, while at more advanced levels girls were overrepresented. It can be seen that 0.1% of girls reached the highest level of proficiency in reading, while on the other side level 2 in reading was not reached by 6% less girls than boys in Lebanon. Similarly to Lebanon, the reading achievements of girls in the OECD countries were considerably higher than the ones of boys.

Figure 2.9

Reading proficiency level distribution among girls in Lebanon compared to the OECD average distribution for girls

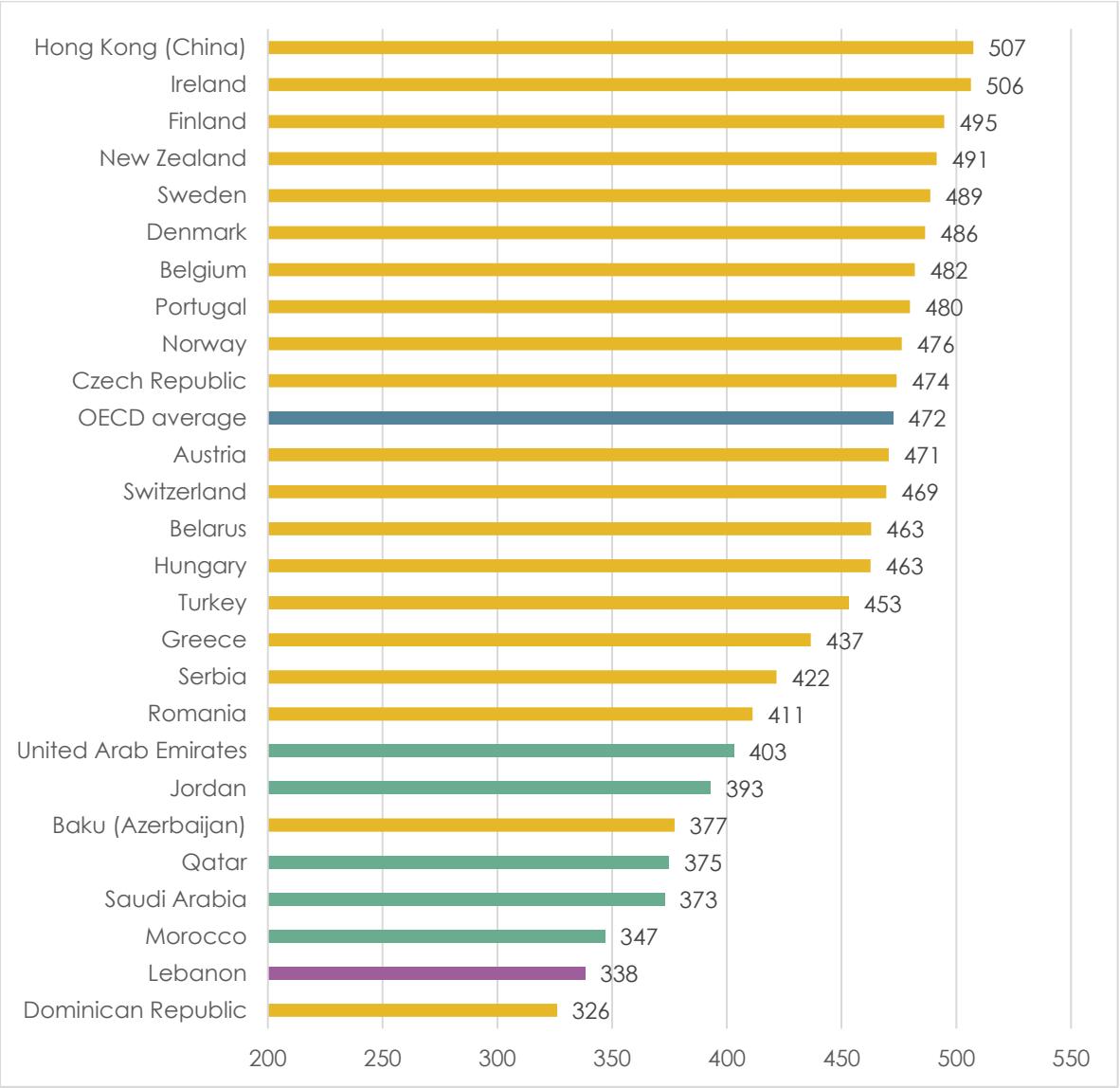


Source: Table A3.5 and Table II.B1.7.2, OECD, 2019c

Figures 2.14 and 2.15 compare the average scores obtained by boys and girls across countries participating in the assessment, respectively. It can be seen that Lebanese students have reached the second lowest place out of 18 countries listed, with no effect given by gender.

Figure 2.14

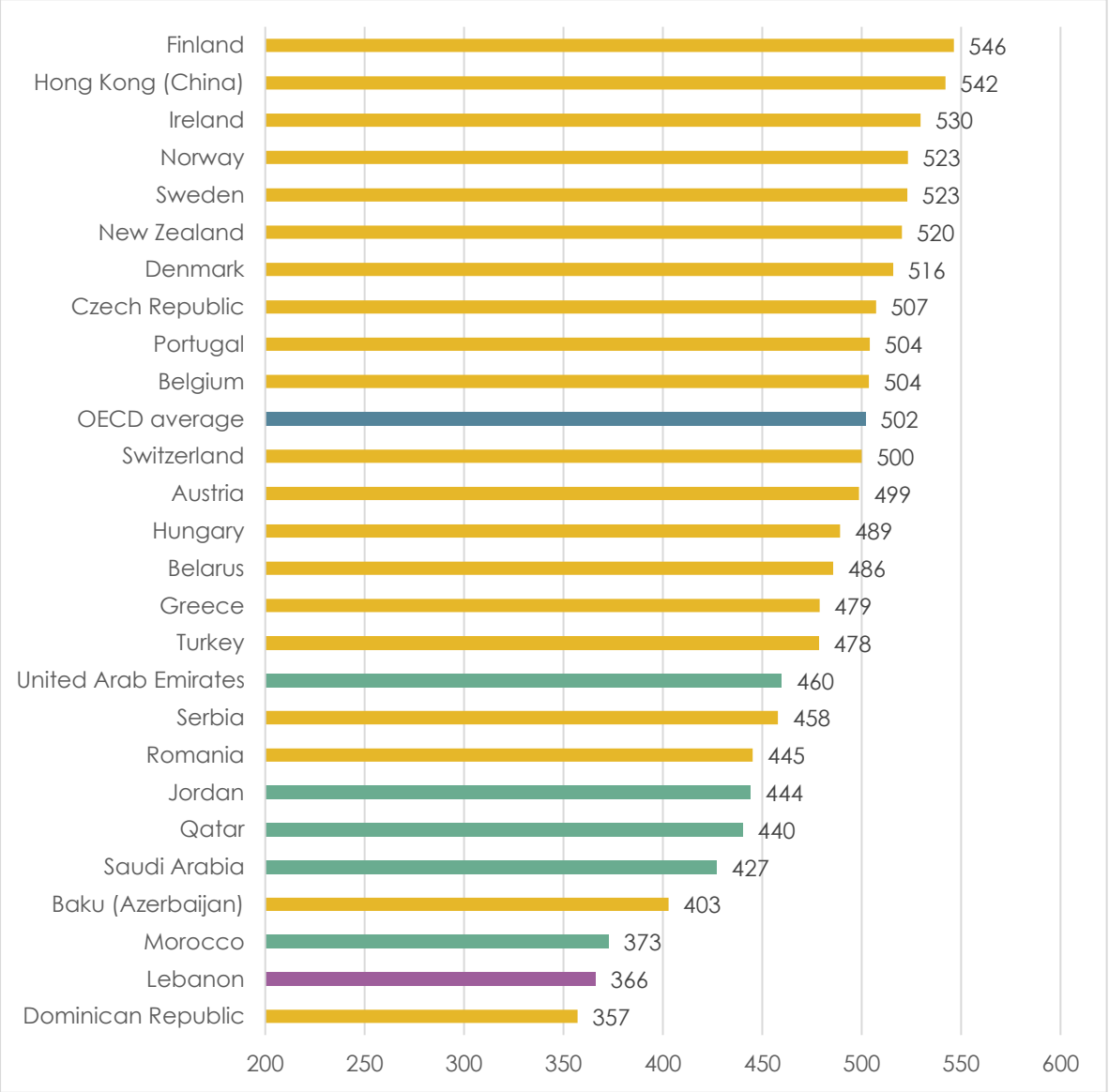
Reading performance of boys—Lebanon compared to the selected countries



Source: Table A3.4 and Table II.B1.7.1, OECD, 2019c.

Figure 2.15

Reading performance of girls—Lebanon compared to the selected countries



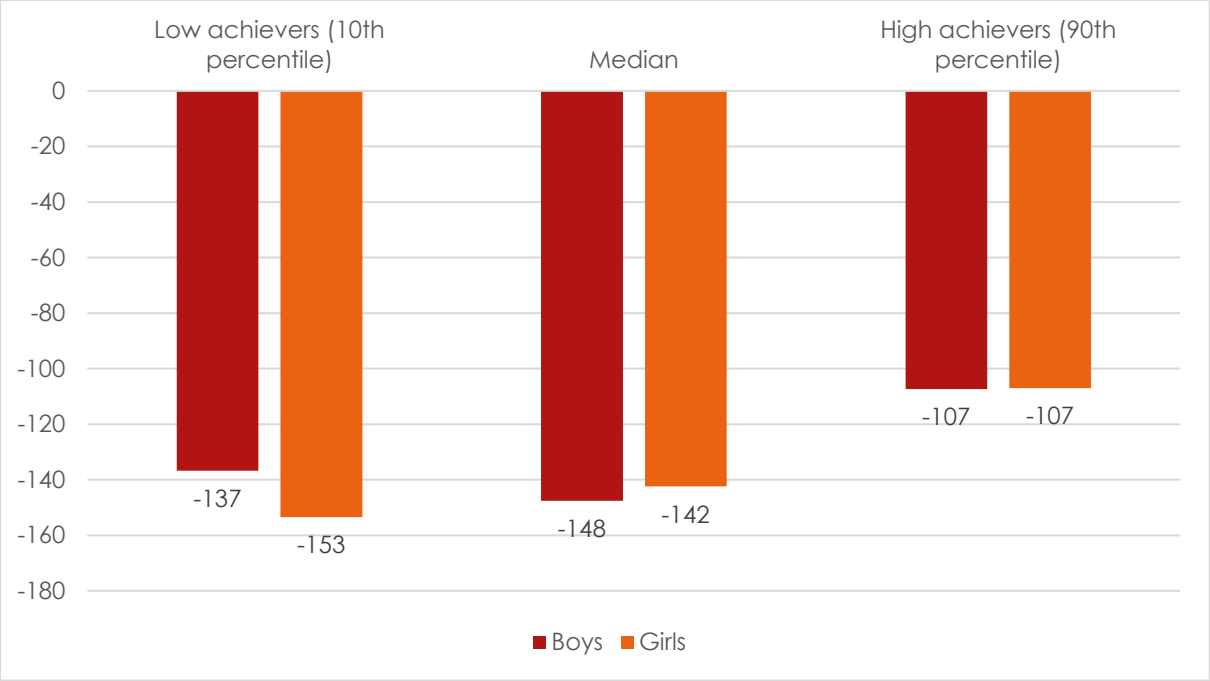
Source: Table A3.4 and Table II.B1.7.1, OECD, 2019c.

Since the distribution of the results in reading differed between boys and girls, the understanding of the gender gap in Lebanon can be improved with an analysis of the differences between high-, average- and low-achievers. Figure 2.16. shows that low-achieving girls in Lebanon scored far fewer points than girls from the OECD countries, similarly to but slightly worse than boys. The median scores were instead comparable between the two genders. Yet, 50% of the poorest-achieving boys obtained lower results by at least 148 points than the OECD median. Interestingly, the

gap between Lebanon and the OECD average among high-achievers is fairly lower than the other gaps for both genders.

Figure 2.10

Comparison of performance of Lebanese boys and girls across the reading score distribution against the OECD average



Source: Table A3.4 and Table II.B1.7.1, OECD, 2019c.

Social, economic, and regional contexts of reading performance

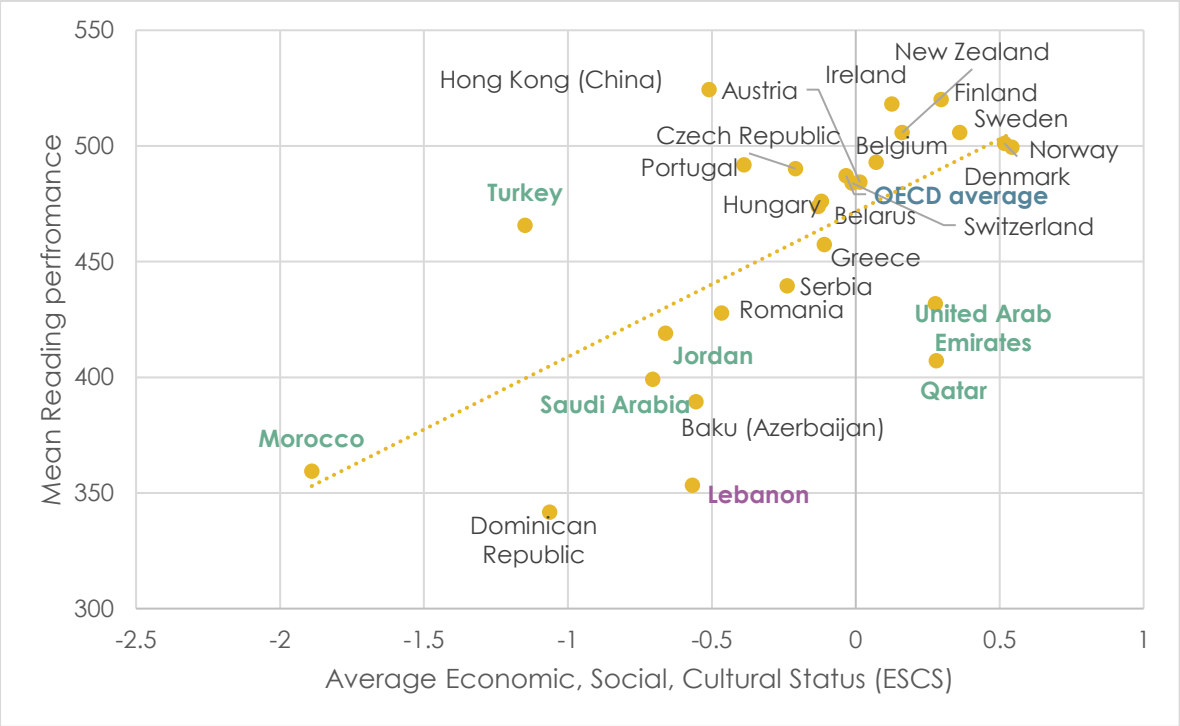
The socioeconomic status of students is often taken into account when analyzing educational performance. In fact, several studies prove that more affluent households are usually benefiting from better health and education (Fergusson et al., 2008). However, it should also be noticed that the inequalities between students with different socioeconomic statuses are impossible to eliminate, since they might result from the lack of supportive resources for learning and limited support from parents and caretakers, who might be poorly educated.

The inequalities caused by socioeconomic status are even more substantial in reading than in other subjects because the transmission of the enjoyment of reading and a proper vocabulary are more likely and easier in more affluent families. Even though the influence of socioeconomic status is impossible to eliminate, schools should aim at lowering existing inequalities. Previous PISA editions have found several successful policies which aimed at neutralizing the relationship between socioeconomic status and reading achievements, while some others did not give the expected results.

In the PISA assessment, socioeconomic status is well-defined by the PISA index of Economic, Social and Cultural status (ESCS). This measure is estimated with IRT models, which collect information concerning parental education and occupation, as well as a long list of questions describing the home resources available to the students. The ESCS index is standardized, so it has an average value of zero and a standard deviation of 1 across the OECD countries, weighting each country equally. The negative value of the index translates into a lower average socioeconomic background than observed on the OECD average, while positive values reflect a higher level of socioeconomic status. Figure 2.17 shows the relationship between the PISA index of economic, social and cultural status and average performance.

Figure 2.11

Reading performance and student socioeconomic background (ESCS index)



Source: Table A3.1 and Table II.B1.2.1., OECD, 2019c.

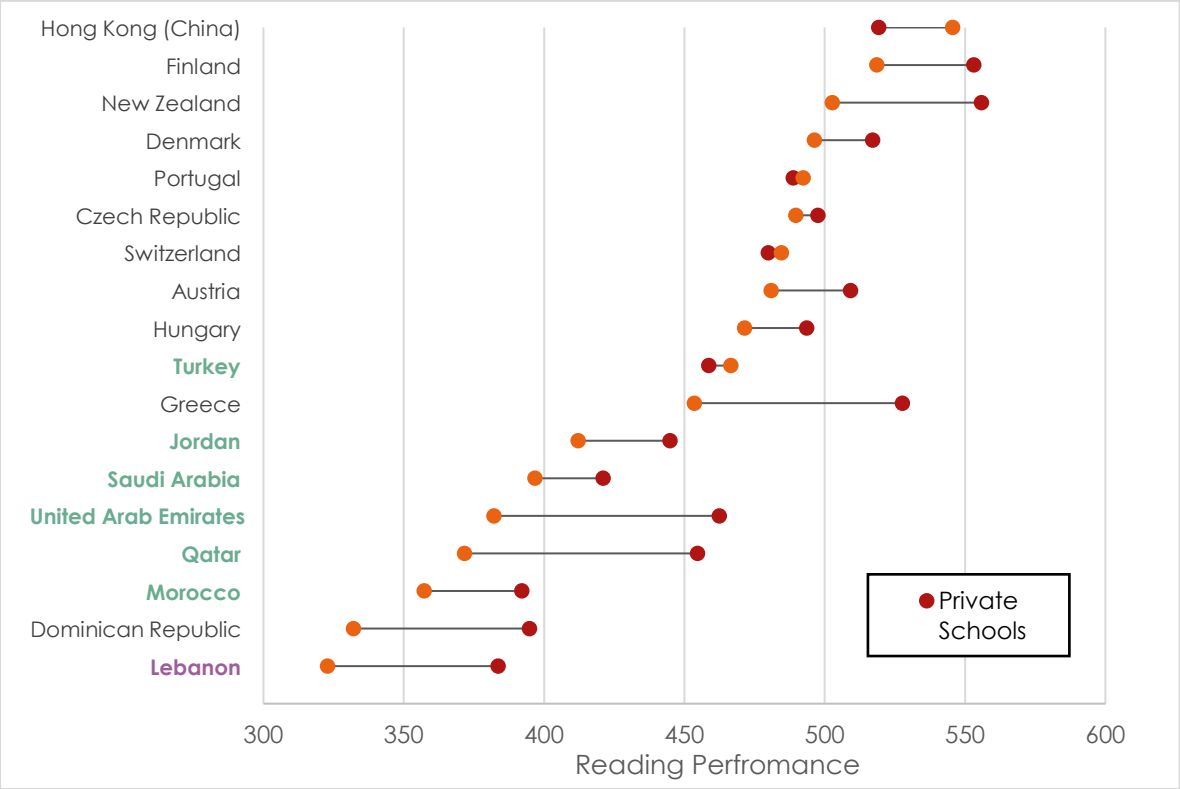
It can be observed that the correlation between socioeconomic status and average performance is positive and strong, indicating that the higher the socioeconomic status, the higher average performance in reading. Among the participating countries, the range of the PISA index is in the interval between -2 (observed in Morocco) and 0.5 (observed in the Scandinavian countries). it can be seen that the vast majority of the participating countries is very close to the trendline, yet the Hong-Kong, Finland and Ireland stand among the countries above the line. These countries are the top achievers in the reading assessment.

On the other hand, Lebanon, Saudi Arabia and Qatar are the countries where the vertical distance from the trendline is the largest, indicating that the country's socioeconomic status should generate a better performance in reading, but also that countries with similar socioeconomic situation are able to perform better. In Lebanon, the index value is equal to -0.6, which should correspond to around 438 points in the reading assessment: therefore, the difference between the trendline and the empirical results in Lebanon equals around 86 points, which is the second-highest difference between the estimated results and the empirical results.

More affluent parents can afford to provide education in private schools for their children. They may decide to do it, because private schools usually offer smaller classes, organize additional classes, hire more competent teachers. In consequence, in countries with large influence of the private sector, the differences between students achievements resulting from the type of school might be significant. Figure 2.18, presented below, compares the average score in reading between private and public schools.

Figure 2.18

Difference in reading performance between private and public schools



Source: Own calculations using PISA 2018 microdata

Out of selected economies, only in Hong Kong, Portugal, Switzerland and Turkey students from public schools received better results than their peers from private schools. In Lebanon, similarly to some Arab countries, such as the UAE and Qatar, there is a substantial difference between students, based on the type of schools they attend – private schools' pupils scored 60 points more. The gap in the achievements between sectors might be resulting partly from the difference in the quality of teaching not only reading itself, but also reading in foreign language. The quality of teaching English and French might be higher in private institutions, and in consequence, reading tasks might be easier for students from private schools.

Chapter 3. Mathematics performance of Lebanese students from an international perspective

Overview of the results

The 2018 PISA assessment shows that the performance of Lebanese 15-year-old students in mathematics is 96 points below the OECD average. Even though the average score in mathematics of Lebanon is slightly higher in comparison to the reading assessment, the position in the international ranking remains low, reaching 67th place out of 79 participating countries. Moreover, it is possible that the results in mathematics are better because of less difficulties encountered in the assessment itself, since numbers may be more easily interpreted than a test in a foreign language. In only 29 countries and economies students exceeded the OECD average, which accounted to 489 points. It can be therefore said that there are few countries in which students were outstandingly successful in the mathematics assessment and brought up the average, whereas some of them failed to reach the lowest international benchmarks.

Statistically, the average results obtained by Lebanese students were similar to their peers from Costa Rica, Peru, Jordan, Georgia, North Macedonia and Colombia. Students from Brazil have obtained also similar results, however with statistically significant differences. Below the Lebanon average score there were only 10 countries such as Indonesia, Saudi Arabia, Kosovo and the Philippines (see exhibit 3.1). Students from Lebanon have obtained worse results by around 30 points compared to students from developed MENA countries, such as the United Arab Emirates and Qatar.

Exhibit 3.1

List of countries with higher, lower, and similar results to Lebanon.

Countries with lower average performance	Argentina, Brazil, Indonesia, Morocco, Kosovo, Panama, Philippines, Dominican Republic, Saudi Arabia
countries with similar performance	Costa Rica, Peru, Jordan, Georgia, North Macedonia, Colombia
countries with performance higher by up to 50 score points	Malaysia, Albania, Bulgaria, United Arab Emirates, Brunei Darussalam, Romania, Montenegro, Kazakhstan, Moldova, Baku (Azerbaijan), Thailand, Uruguay, Chile, Qatar, Mexico, Bosnia and Herzegovina, Costa Rica, Peru, Jordan, Georgia, North Macedonia, Colombia, Brazil,
countries with higher performance but not above the OECD average	Portugal*, Australia, Russia, Italy, Slovak Republic, Luxembourg, Spain, Lithuania, Hungary, United States*, Belarus, Malta, Croatia, Turkey, Ukraine, Greece, Cyprus, Serbia,
countries above the OECD average	B-S-J-Z (China), Singapore, Macao (China), Hong Kong (China)*, Chinese Taipei, Japan, Korea, Estonia, Netherlands*, Poland, Switzerland, Canada, Denmark, Slovenia, Belgium, Finland, Sweden, United Kingdom, Norway, Germany, Ireland, Czech Republic, Austria, Latvia, Vietnam**, France, Iceland, New Zealand

Source: Table A4.1 and Table I.B1.5, OECD, 2019.

Note: *did not obtain PISA technical standards, **results not fully validated

Figure 3.1. presents the comparison of the average scores in mathematics in the participating countries. The top ten achieving countries in mathematics included three inland provinces of China (B-S-J-Z, Macao and Hong Kong), four countries and economies from Eastern Asia (Korea, Japan, Chinese Taipei, Singapore), as well as three European countries (Estonia, The Netherlands and Poland). It is worth mentioning

that out of these ten countries and economies, seven of them have also been found in the top ten countries in the reading achievement.

Figure 3.12

Comparison of average mathematics scores in Lebanon and selected countries

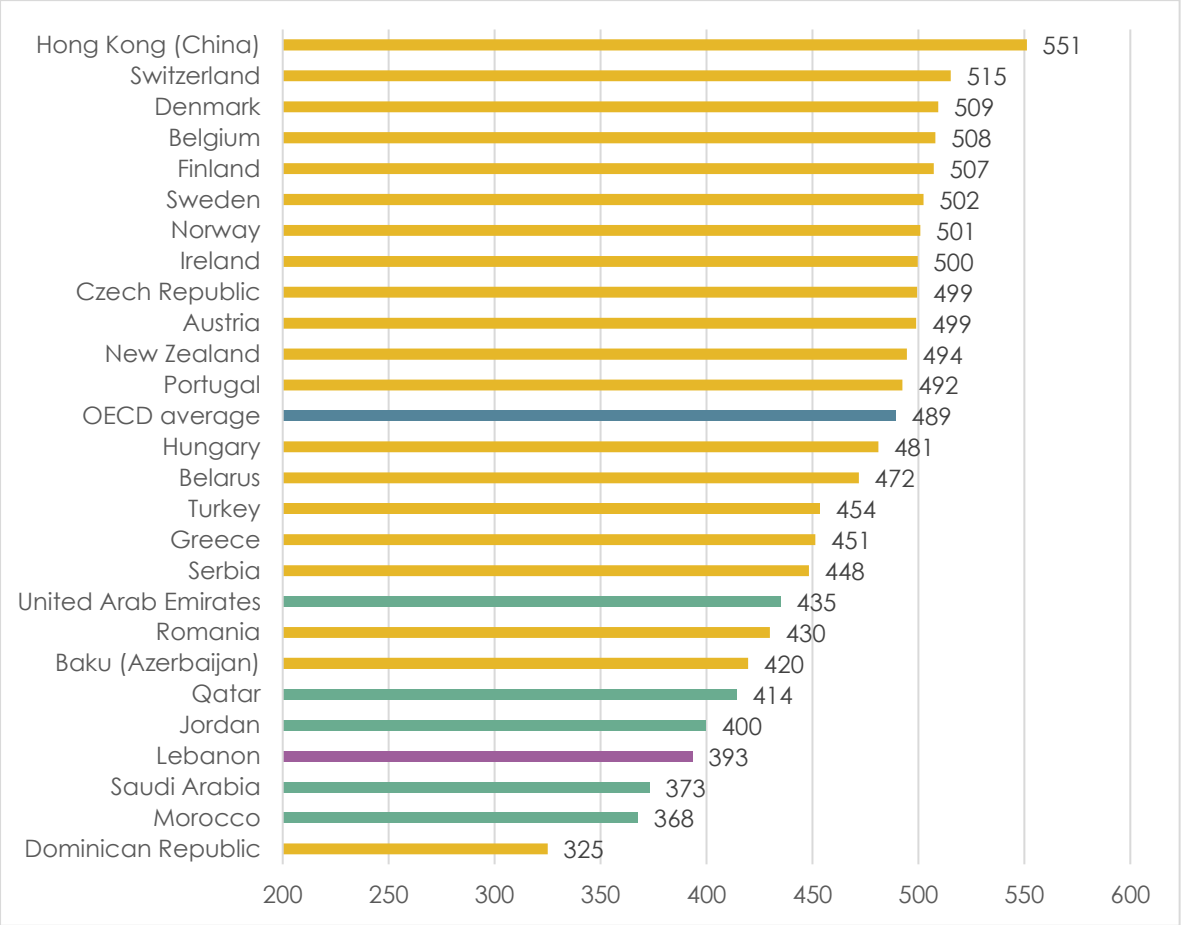


Table A4.1 and Table I.B1.5, OECD, 2019.

The performance of the top achieving countries and economies varies, as the range of the score obtained by the 10th and 1st country is almost equal to one standard deviation of the assessment score, equal to 100 points. Among the four most successful participants in the mathematics assessment, there are three inland provinces of China and Singapore: it should be noted that these economies are fairly small and might remain incomparable to larger educational systems, such as the United States or the United Kingdom. Thus, the comparison might be biased due to the resulting problems connected to the inequalities observed within the economy or by difficulties with managing large systems. Yet, there are some educational systems

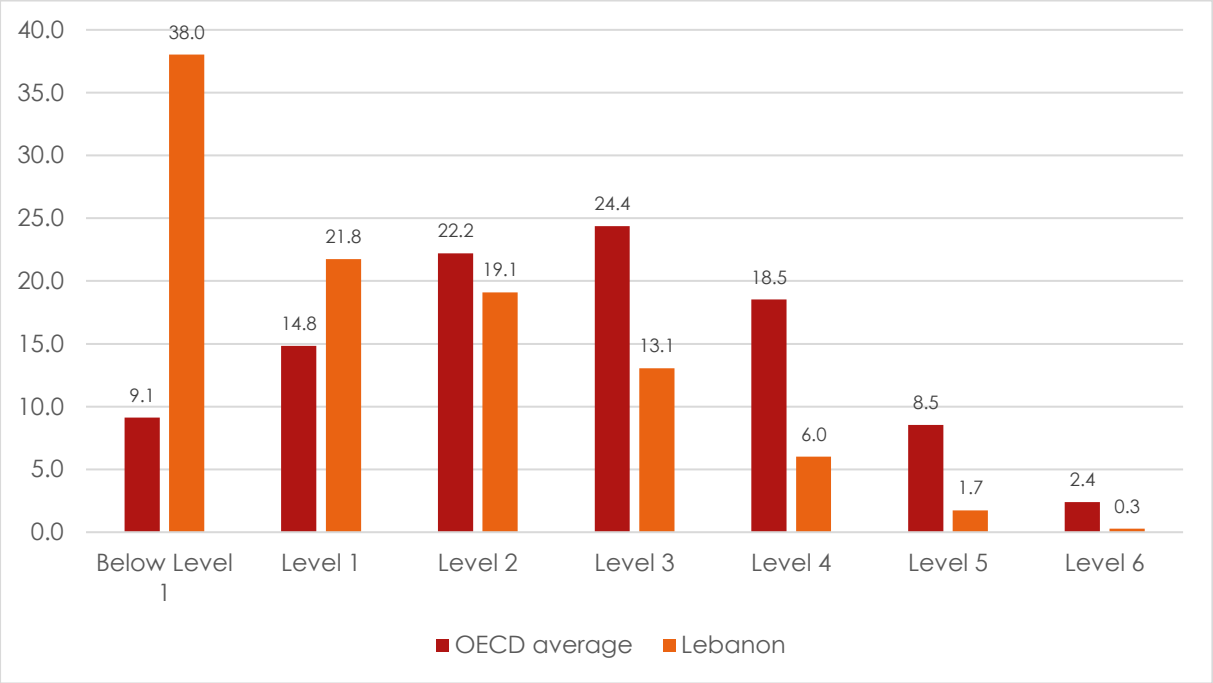
of a more substantial size among the successful participants, such as Poland, Japan, and Korea. In these countries, a high performance was achieved by the students.

The analysis of the average mathematics assessment results can be used to compare the educational systems across countries and economies participating in the assessment. Nonetheless, it can be noted that the average performance is a measure which can be significantly affected by outliers, and not provide meaningful information about the distribution of the competencies among students. The designers of the PISA framework have established different international benchmarks that describe the knowledge and abilities of students, depending on the score they have achieved. In the mathematics part there are six proficiency levels, with the sixth comprising the students who are the most proficient in mathematics. Figure 3.2. compares the percentage of students at different proficiency levels in mathematics. In educational research, the second level of proficiency is recognized as the level of competencies that each 15-year-old student should reasonably possess thanks to her age and her previous education.

It can be seen that more than 1/3 of the Lebanese 15-year-old students participating in the assessment is underperforming in mathematics, while in other countries less than 10% of students experience such problems. Moreover, almost 60% of students from Lebanon did not obtain the second level of proficiency. The rest of the Lebanese students is mostly found at the level 3 and 4, while only 2% of students from Lebanon is capable of reaching the most advanced levels in mathematics. On international average, the largest share of students is represented at the level 3, while 1 in 10 students reaches either the fifth or the sixth proficiency level in mathematics. It is possible to observe that large inequalities exist between the OECD countries and Lebanon, and also that the competencies of Lebanese students are centred below the second level of proficiency.

Figure 3.2

Percentage of students at different mathematics proficiency levels in Lebanon and on average across 36 OECD countries



Source: Table A4.2 and Table I.B1.1, OECD, 2019.

Figure 3.3 compares the distribution of students' share reaching different proficiency levels in mathematics in selected countries participating in the PISA assessment. Since in some countries and economies there is a small share of students reaching some of the levels of proficiency, for the sake of clarity below level 1, and level 1 were grouped into below level 2 category; similarly, level 5 and 6 were combined into a single category. In the best achieving countries, the share of students reaching a different level of proficiency vary. In the Hong-Kong, there is an outstanding group of advanced students, since around 30% of students have reached either levels 5 or 6 of proficiency in mathematics, while in other countries the share of students in this category is either small or statistically equal to zero. In the Asian top-achieving countries, students below level 2 do not exceed 10%. In the top achieving European countries and economies, such as Finland, the share of underperforming students is slightly lower than the share of advanced students. Yet, in countries such as Switzerland, even higher shares of students have reached the most advanced levels of proficiency in mathematics. At the same time, the share of students that did not reach level 2 was slightly larger than in Finland. Thus, it can be

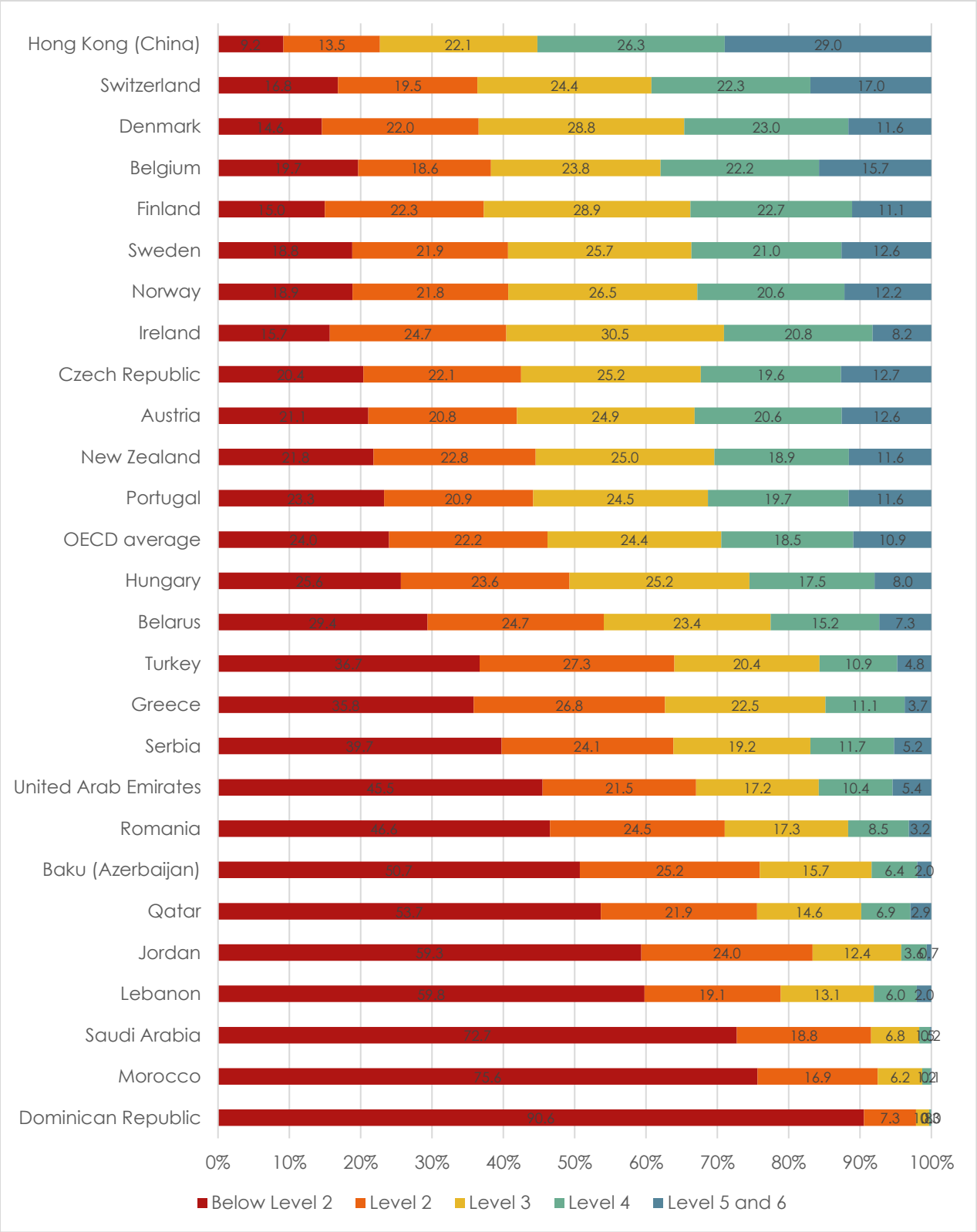
concluded that in the most successful countries the support system is not only focused on the highest achieving students, but also addresses the needs of the low achieving students.

In the majority of the countries participating in the PISA assessment, it can be seen that the share of underperforming students remained at a considerably high level. In 24 out of 79 countries including Lebanon, more than half of students did not obtain the second proficiency level in mathematics. By looking at the countries neighboring Lebanon, it can be seen that in Jordan and Saudi Arabia the share of underperforming students was even more substantial. Conversely, in Turkey almost half of the students did not obtain at least level 2 in mathematics, compared to Lebanon. Therefore, it is difficult to determine whether any cultural factors affect the performance of the 15-year-old students in mathematics.

Another insightful approach in looking at the performance of students is comparing the 10th percentile of the results in mathematics. By doing this, it is possible to determine how the educational systems are dealing with the issues of the most disadvantaged students. As the low-achieving students might have more problems related to their socioeconomic status, motivation and a lack of a supportive home environment, it can be expected that the educational system will provide certain tools aimed at neutralizing the impact of the student's background. Over the years, some countries and economies have succeeded in providing accessible education for the most disadvantaged students, while some have focused on the top achieving pupils without considering the needs of underperforming students. The results of the 10th percentiles of the achievements in mathematics are shown in figure 3.4.

Figure 3.3

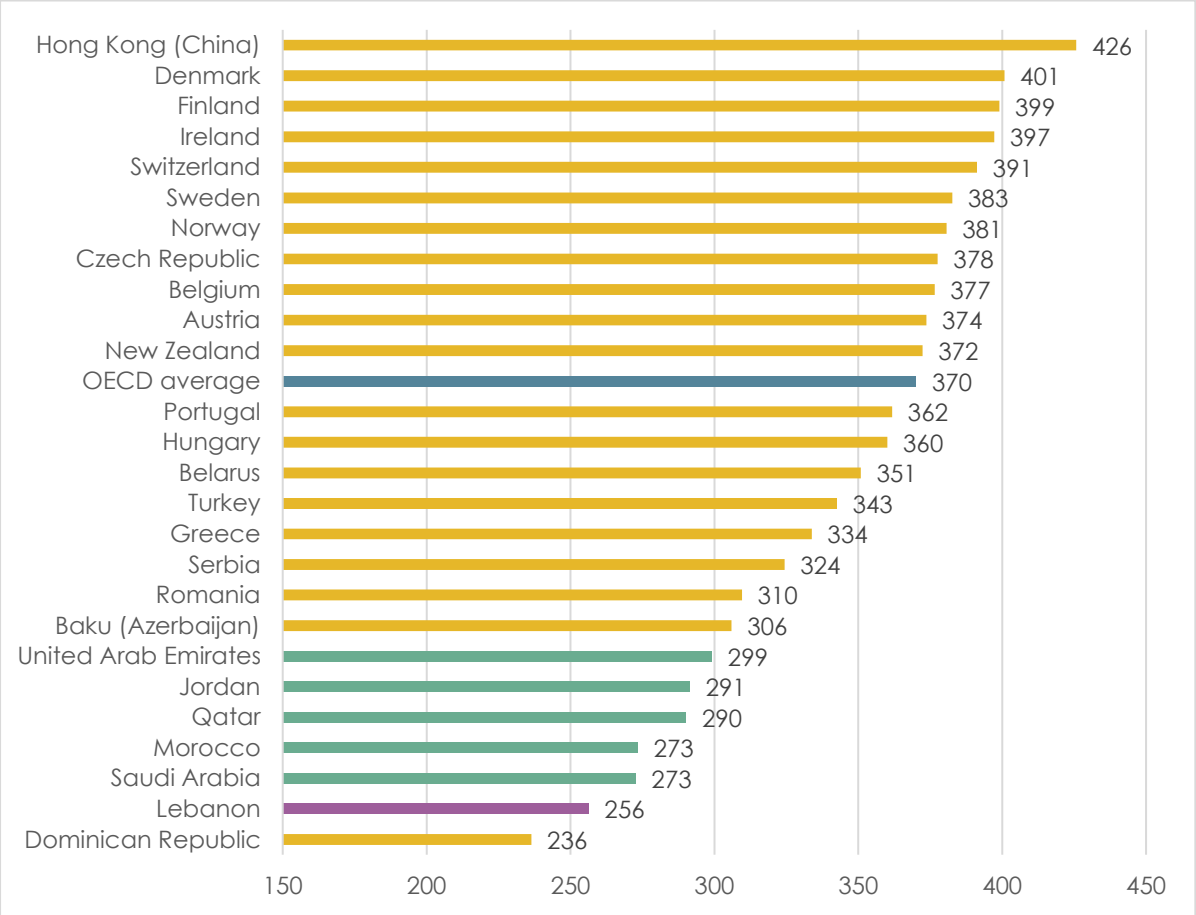
Mathematics proficiency level distribution across selected countries



Source: Table A4.2 and Table I.B1.1, OECD, 2019.

Figure 3.4

Comparison of performance of low-achieving students in Lebanon and the selected countries (10th percentile of mathematics)



Source: Table A4.3. Own calculations from the PISA database.

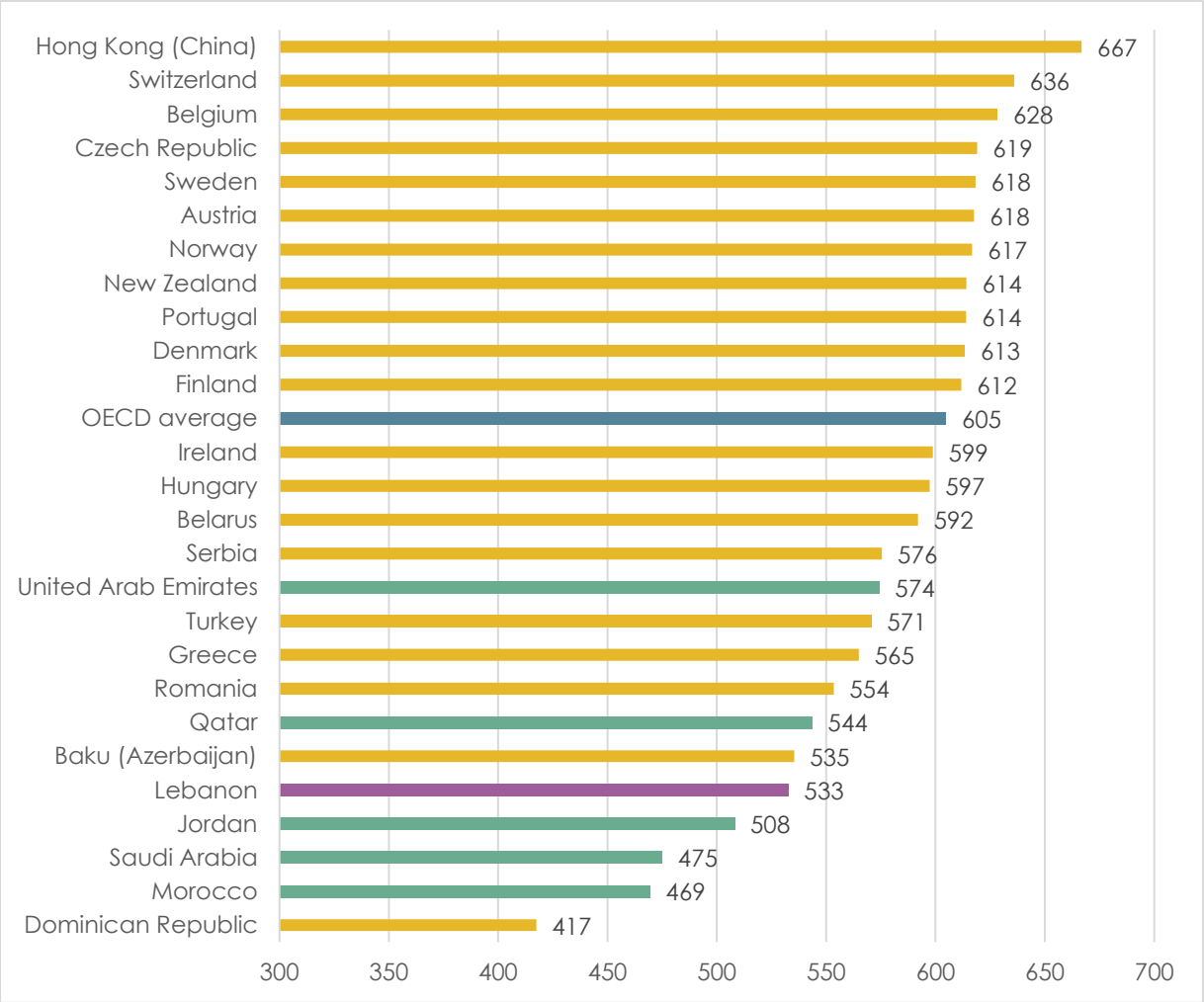
The figure shows that the low-achieving students in Hong-Kong obtained results in mathematics close to 400 points, and in successful European countries, the poorest resulting students obtained around 400 points. It can be said that among underperforming students in the most successful countries and economies, the differences between students are easily distinguishable since the range of the achievements between the top ten achieving countries and economies is equal to almost one standard deviation (equal to 100 points).

Lebanese low-performing students obtained the second lowest score in the mathematics assessment among participating countries and economies. Moreover, the difference between the score obtained on average by Lebanese students and students in Dominican Republic was not statistically significant. Such outcome might

indicate the critical situation of the lowest-achieving students in Lebanon, which is also confirmed by the fact that the achievements of an average Lebanese students were the eleventh lowest among PISA participants. Similarly, the achievements of the outperforming students (90th percentile) are compared in figure 3.5. It can be noticed that the disparities between the top achieving countries are considerably lower than in the case of poor-performing students. Only in Hong Kong students that reached the 90th percentile have almost met the most advanced proficiency level in mathematics. The best-performing students have obtained more than 600 points in mathematics on the OECD average. Lebanese best students have obtained on average 70 points less than the OECD average, reaching the 20th lowest score among participating countries and economies. Even though the performance of Lebanese best-achieving students was not significantly high, it is possible to see the existence of large disparities in the position of the low-achieving and high-achieving students. It can be said that the Lebanese educational system does not deal properly with the problems of low-achieving students, which possibly may arise from socioeconomic status.

Figure 3.5

Comparison of performance of high-achieving students in Lebanon and the selected countries (90th percentile)



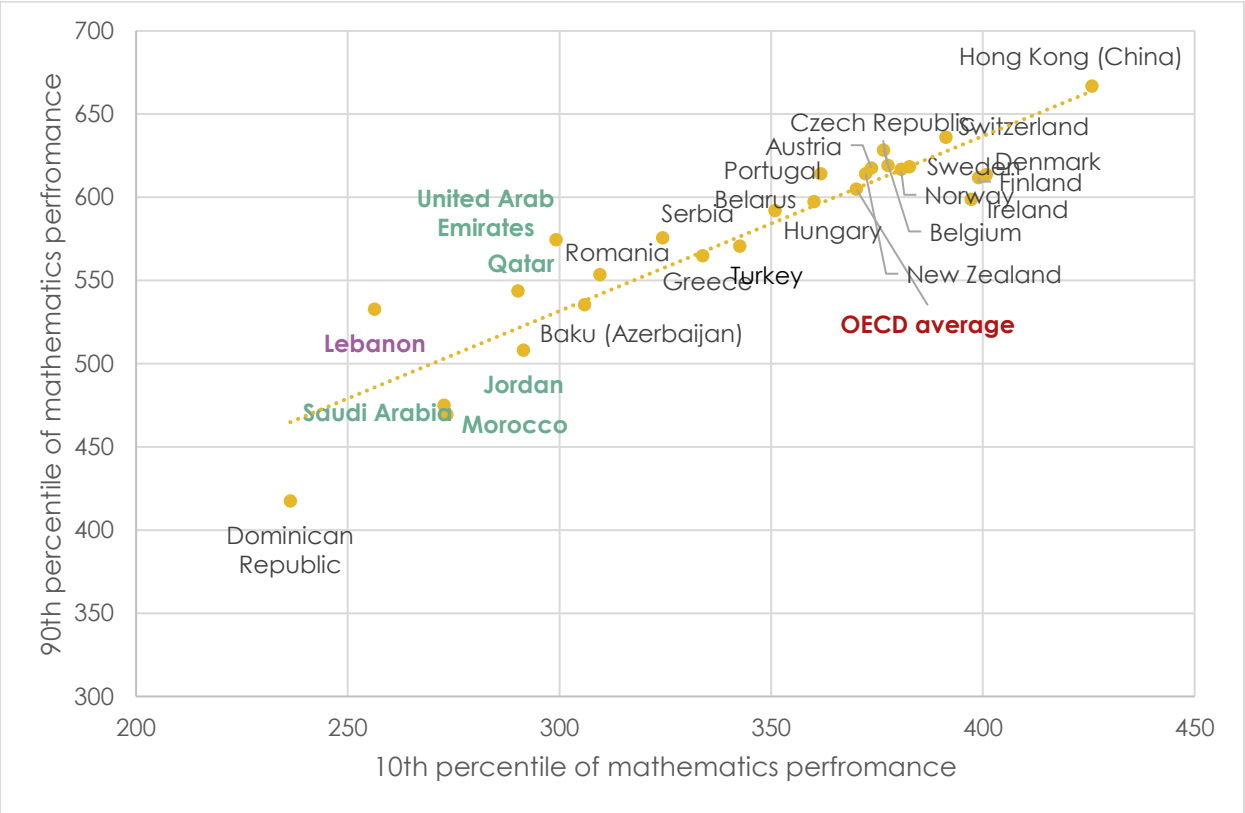
Source: Table A4.3. Own calculations from the PISA database.

Figure 3.6. compares the 10th and 90th percentile of the students results in mathematics, which reflect respectively the performance of low- and high-achieving students. For the sake of the analysis, a trendline was calculated to check whether the performance of students was exceeding the expected value. It can be observed that the correlation between the performance of low- and high-achieving students is considerably high.

Among the top-achievers, no visible pattern in the difference between the observed values and the trendline can be found. Denmark and Finland were found among countries where low-achieving students have underperformed, while the rest of the top-achieving countries were characterized by relatively high-performance of the best achieving students.

Figure 3.6

The relative performance of low- and high-achieving students (10th and 90th percentiles of mathematics performance)



Source: Table A4.3. Own calculations from the PISA database.

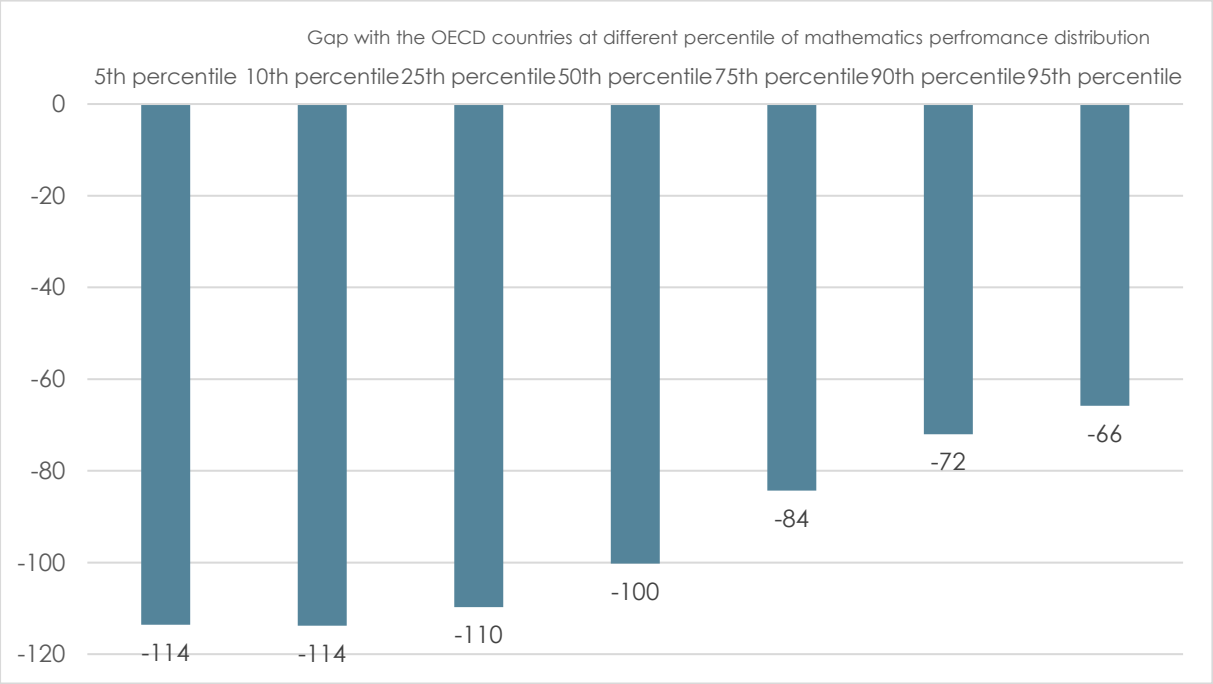
On the contrary, in Lebanon, Dominican Republic and in the United Arab Emirates the residuals were the largest among the selected countries: in order to reach the results indicated by the trendline, the low-achievers from Lebanon should obtain at least 50 points more, which further indicates the failure of the Lebanese educational system in addressing the needs of the most disadvantaged students.

Figure 3.7. shows the comparison of the performance of Lebanese students compared to the OECD average, with each bar corresponding to the difference between the achievements at a given percentile. It can be seen that the achievement gap is lower at more advanced levels, which indicates that the best Lebanese students are only 66 points behind the OECD top-achievers, while the poorest performing students are more than one standard deviation below the OECD countries. Moreover, it can be seen that the gap decreases significantly between the 50th and 75th percentile. Since the distribution of the gaps is skewed to the right, it can

be stated that the educational systems in Lebanon face challenges with the performance of the lowest-achieving students.

Figure 3.7

Comparison of performance of Lebanese students across the mathematics score distribution with the performance across the OECD countries



Source: Table A4.3. Own calculations from the PISA database.

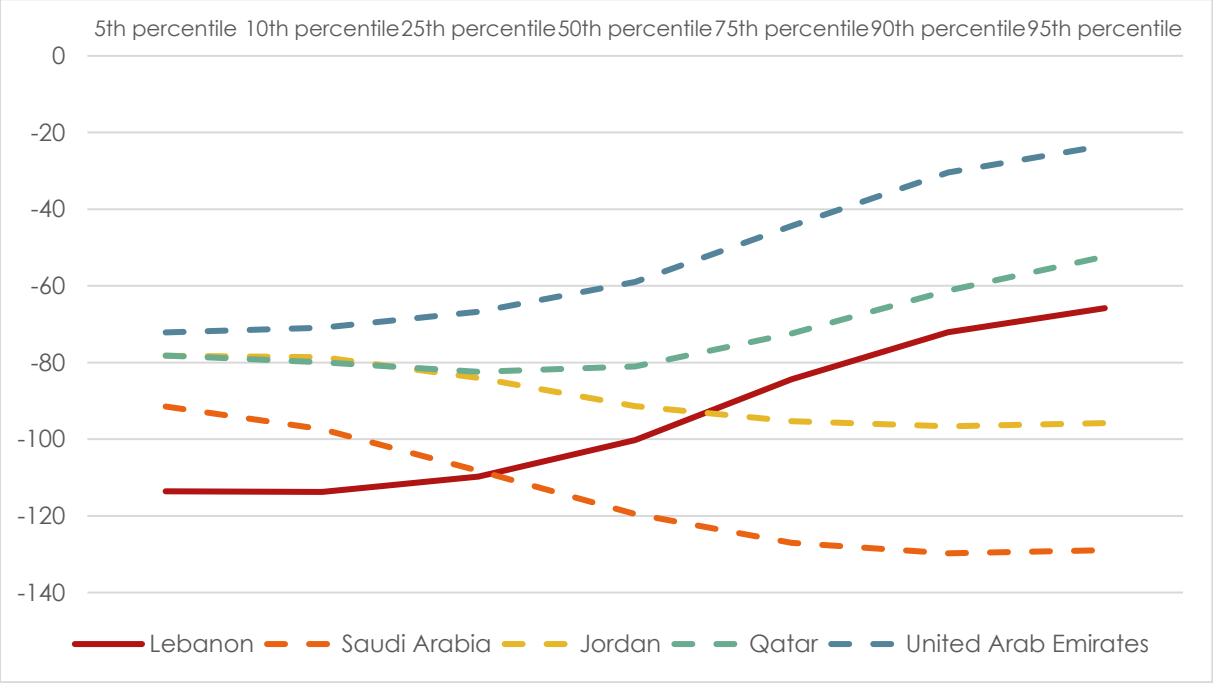
Since some patterns might be observed more frequently within given geographical or cultural areas, it is worth comparing the Lebanese-OECD achievements gaps to the gaps observed in countries from the closest neighborhood that obtain similar results in mathematics. Figure 3.8. compares the achievements gaps between the OECD countries and Lebanon, Saudi Arabia, Jordan, Qatar, and the United Arab Emirates.

In Qatar and the United Arab Emirates, the inequalities are comparable to the ones observed in Lebanon, since the highest achievement gap is found among underperforming students and decreases over higher percentiles. However, in the United Arab Emirates achievement gaps start to decrease from the median score and the range of the achievements gaps decreases at a similar pace to Lebanon, while in Qatar the range of change is lower.

The measures of dispersion provide information about the heterogeneity of the results obtained in the mathematics assessment. Such measures are provided in the form of the standard deviation, which indicates the variability in the observed results. Figure 3.9. shows the standard deviations in the achievements of selected countries.

Figure 3.8

The gap between the OECD average and mathematics performance at different percentiles for selected countries with similar average performance to Lebanon (the more substantial negative value shows a more significant gap against the OECD average)

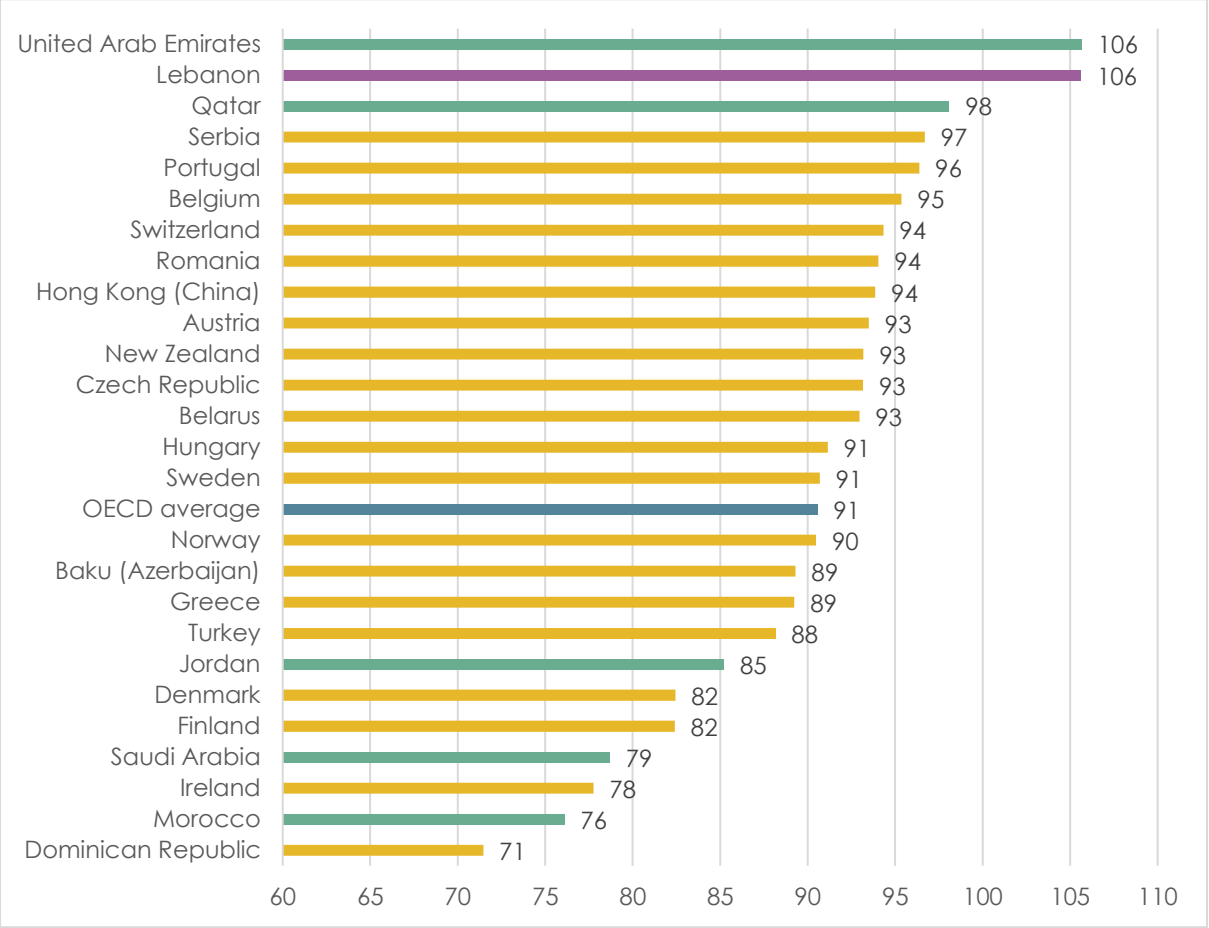


Source: Table A4.3. Own calculations from the PISA database.

In the top achieving economies such as Hong Kong and Switzerland, the standard deviation slightly exceeded the variation of the OECD countries, while in other advanced economies the range of dispersion was lower. Interestingly, in Finland and Ireland the standard deviation was lower than in other countries and economies by around 10-15 points, which means that in these countries the dispersion of the mathematics results is relatively low. This might stem from the overperformance of the most disadvantaged students, since the average scores of the poor-achieving students remained at a considerably high level. This could be an indication of the fact that the policies adopted in these economies were designed to minimize achievement gaps.

Figure 3.9

Variation in student performance



Source: Table A4.3. Own calculations from the PISA database.

On the contrary, among the top ten worst-achieving countries and economies, 7 of them were characterized by a standard deviation lower than 80 points. This implies that in the lowest achieving countries there is not a high heterogeneity in the results. It seems that the poor performance of these countries is connected to the generally low quality of the educational systems, which not only affects the high-achieving students but also the most disadvantaged ones.

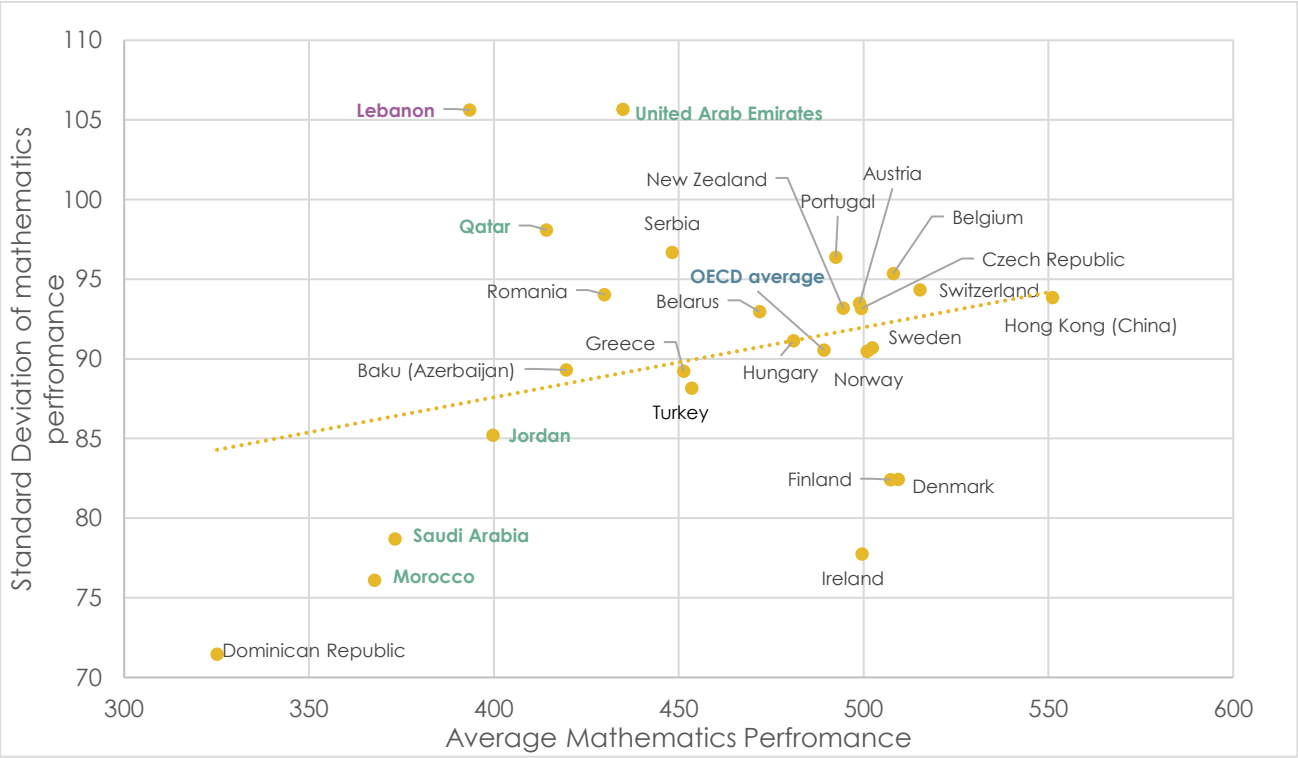
Lebanon, which was placed as the 11th poorest achieving economy in the assessment, exhibits the third-largest standard deviation in the mathematics achievements. This confirms that there are vast inequalities in academic performance between students in Lebanon, possibly due to the differences in socioeconomic status, school's location and the type of the school. Thus, it is highly important to

conduct a policy-orientated analysis of the sources of the heterogeneity of the achievements of Lebanese students, since this may lead to an improved performance in large-scale assessments.

Differently than in the case of the reading assessment, the variation in the performance of students was not well explained by the average achievements of students. Figure 3.10 shows the standard deviation in relation to the average assessment, and it can be observed that the R-squared statistics indicate that the average performance explained only 8% of the variation of the standard deviation. Interestingly, it can be observed that the countries and economies can be divided into regional clusters depending on the average and the standard deviations they exhibit. In particular, there are no large differences between the Scandinavian countries (Sweden, Norway), some European Countries (Greece, Hungary) and Western Europe (Switzerland, Austria, Belgium). Nonetheless, the performance of Lebanese students is strongly outlying the trendline and the countries from the region.

Figure 3.10

Variation against average mathematics performance



Source: Tables A4.1 and A4.3. Own calculations from the PISA database.

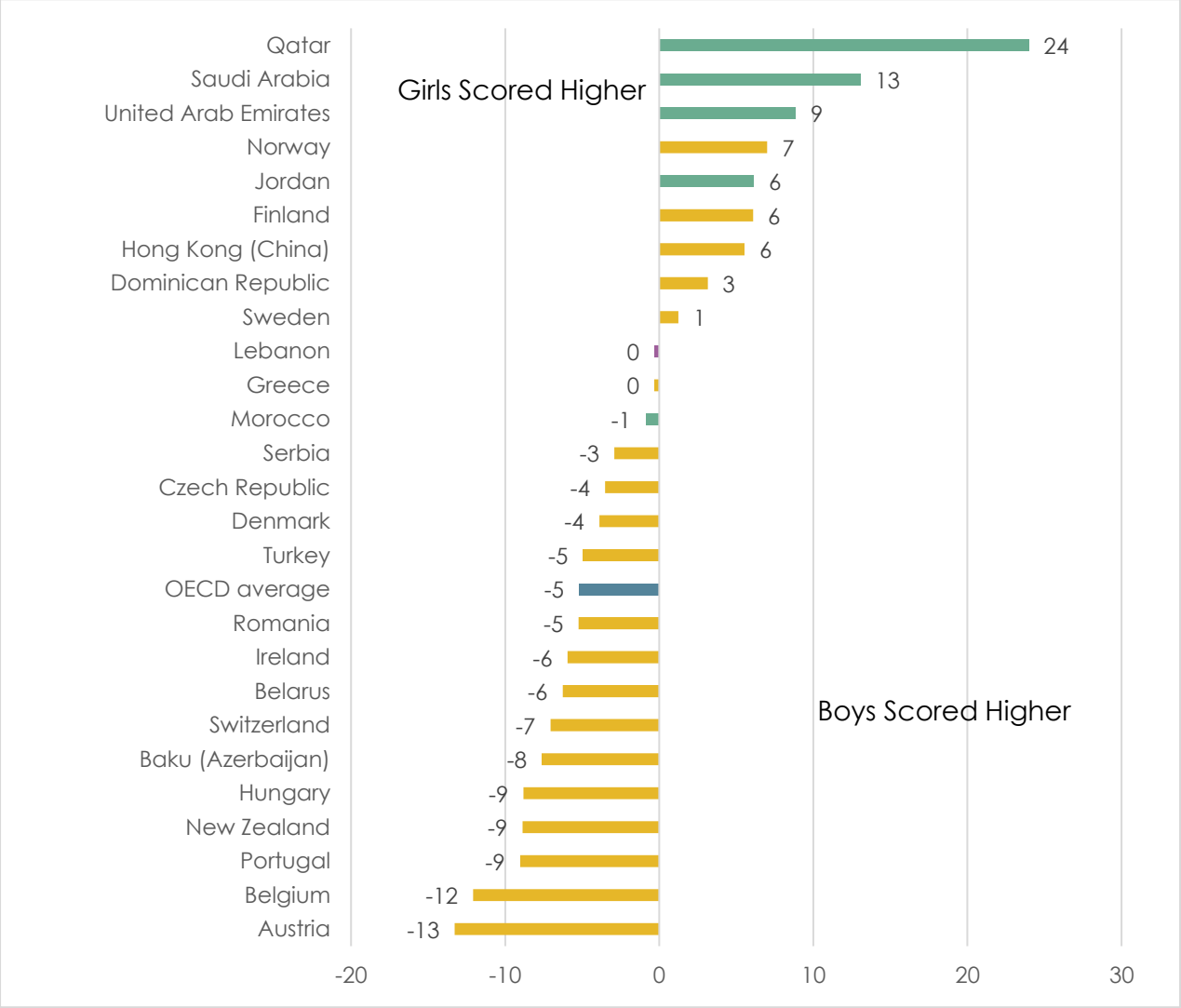
Gender gaps in mathematics achievements

As mentioned in the chapter concerning reading achievements, gender gaps are often discussed in educational studies. In the reading assessment, the performance of boys was far behind the one of girls, while in the mathematics assessment boys scores were higher than the ones obtained by girls. It is advocated that the lower achievements of girls in mathematics and science may lead to the overrepresentation of boys in the Science, Technology, Engineering and Mathematics (STEM) related professions; moreover, as these professions often provide the highest-paying salaries, the gender gaps observed in mathematics might have consequences in shaping the wage gender gap observed in the labor market. Nevertheless, some of the gender gaps result from how boys and girls are brought up too. Dweck proposed a mindset theory, which aims to describe the differences in the motivations of students: it was advocated that girls are more likely to avoid challenges and unfamiliar tasks than boys (Dweck, 1986). According to mindset theory, this results from the fact that girls are more often praised by their parents and educators when achieving success, while boys are motivated during the process of learning. Hence, the differences observed between girls and boys might not necessarily result from the failure or success of the educational system. Nevertheless, the analysis of the gender gaps in mathematics achievements can provide information on which systems are the most effective at tackling this issue.

Figure 3.11 presents the gender gap in mathematics achievements. As it can be observed, in the majority of the countries participating in the PISA assessment, boys received higher results in mathematics than girls. However, when adjusting the differences for statistical significance, only in a few countries the significant differences. Interestingly, the gender gap was not connected to the general performance of the country in the assessment, as in countries with high and poor results large differences were found (such as in Finland, Hong-Kong, Saudi Arabia and Qatar) and the results of boys and girls were almost equal (as in Morocco and Greece). Thus, the gender gap in mathematics does not provide information about the general condition of the educational system. When it comes to Lebanon, there was also no substantial difference between boys and girls.

Figure 3.11

The gender gap in mathematics achievement (performance advantage of boys over girls)



Source: Table A4.4 and Table II. B1.7.1, OECD, 2019.

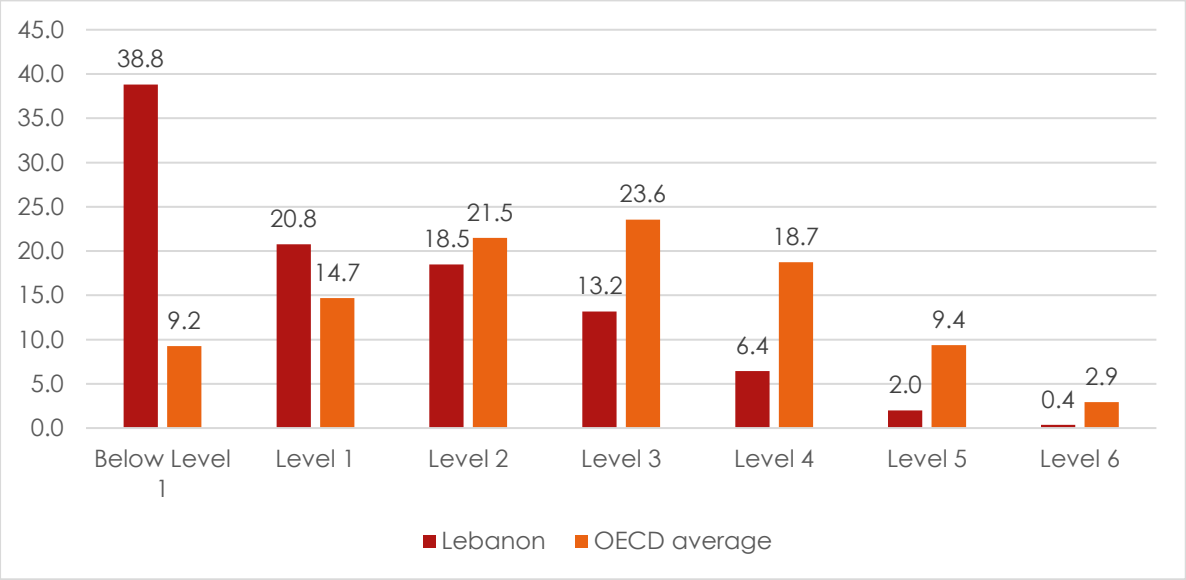
Since the mean is not the best measure to describe the performance of a population, due to its high sensitivity to the outliers. it is much more meaningful to look at the distribution of students at each proficiency level by gender. Additionally, the distribution can be compared to the OECD average, as shown in figures 3.12 and 3.13.

As there was no significant achievement gap between Lebanese boys and girls, it is not surprising that the distributions of their results look fairly similar. The only observable difference is the higher representation of Lebanese boys at the highest level of proficiency. Yet, these distributions are comparable to the right-skewed

distributions, and as a consequence the majority of the Lebanese 15-year-olds did not achieve the second level at mathematics (66.8% of boys and 60% of girls). On the contrary, the distribution of the OECD average students is much closer to the normal distribution, as the vast majority of students were found at the middle levels (2, 3 and 4). In conclusion, even though the gender gap between Lebanese students is almost indistinguishable, the achievements of boys and girls remain fairly low, as they do not exceed 400 points.

Figure 3.12

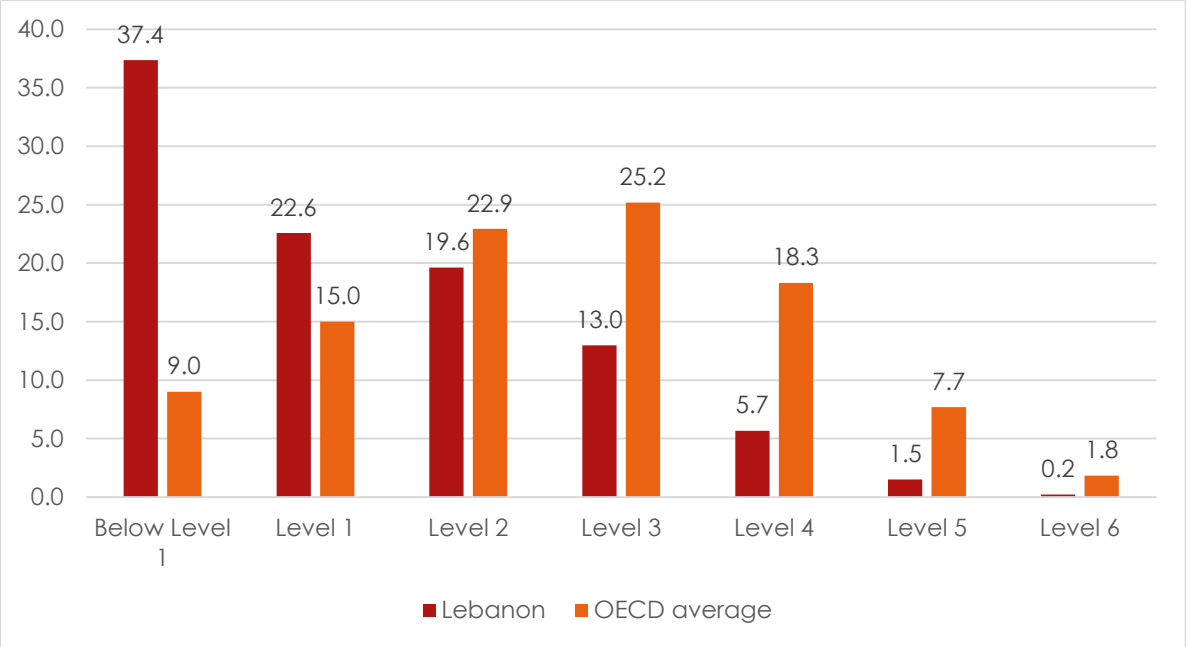
Mathematics proficiency level distribution among boys in Lebanon compared to the OECD average distribution for boys.



Source: Table A4.5 and Table II.B1.7.2, OECD, 2019.

Figure 3.13

Mathematics proficiency level distribution among girls in Lebanon compared to the OECD average distribution for girls.

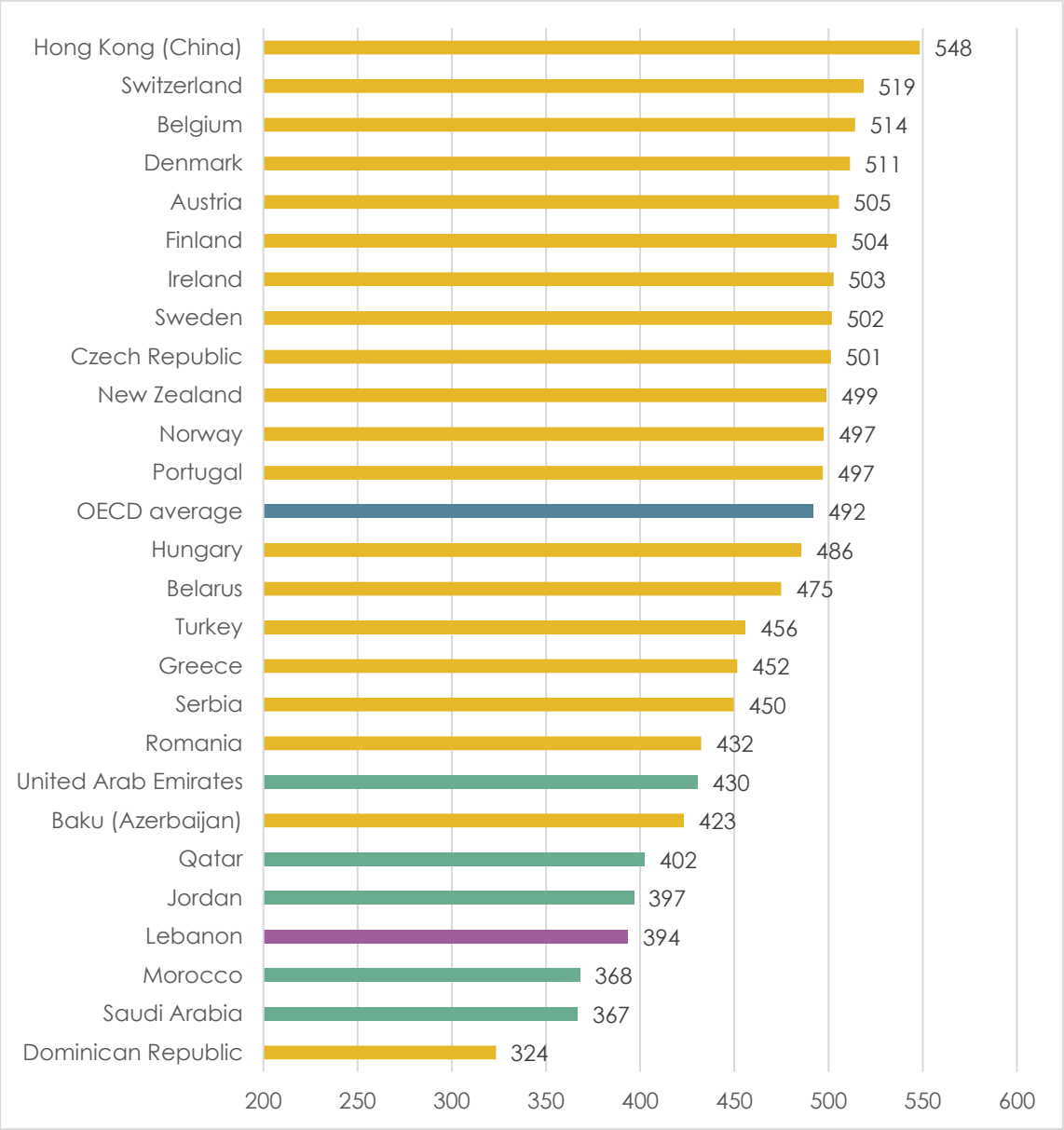


Source: Table A4.5 and Table II.B1.7.2, OECD, 2019.

Another critical issue connected to the gender differences is the position of boys and girls in the ranking. In some countries, the gender differences are so large that the position of girls is different from the one of boys. Yet, this was not the case for Lebanon, since the results were almost the same between boys and girls: Lebanese girls can be found at the 67th position in the ranking, while boys were placed at the 68th position. On the international average, the score of girls was 5 points lower than the one of boys. Figure 3.14 and 3.15 show the rankings of boys and girls from the participating countries and economies.

Figure 3.14

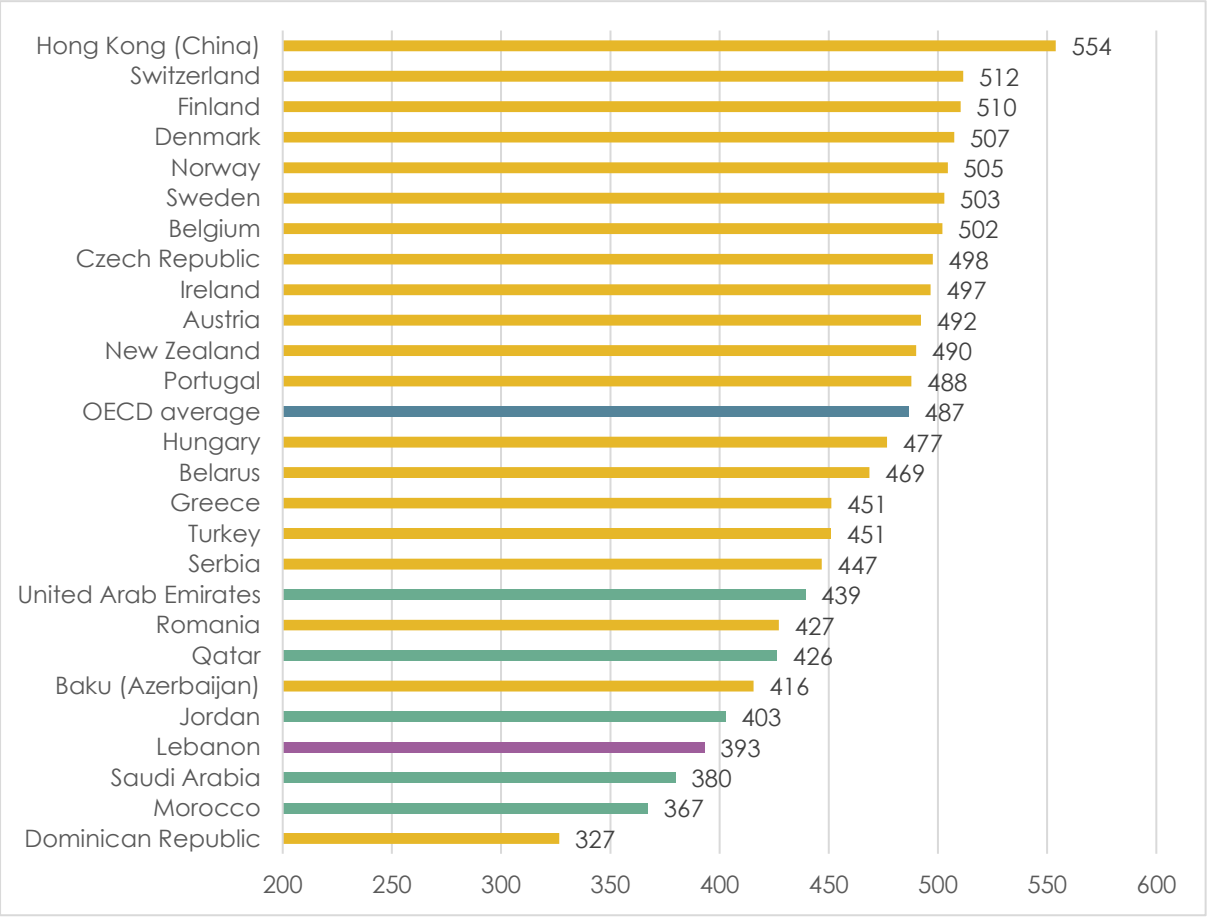
Mathematics performance of Lebanese boys in comparison to the boys from other countries



Source: Table A4.4 and Table II. B1.7.1, OECD, 2019.

Figure 3.15

Mathematics performance of Lebanese girls in comparison to the girls from other countries



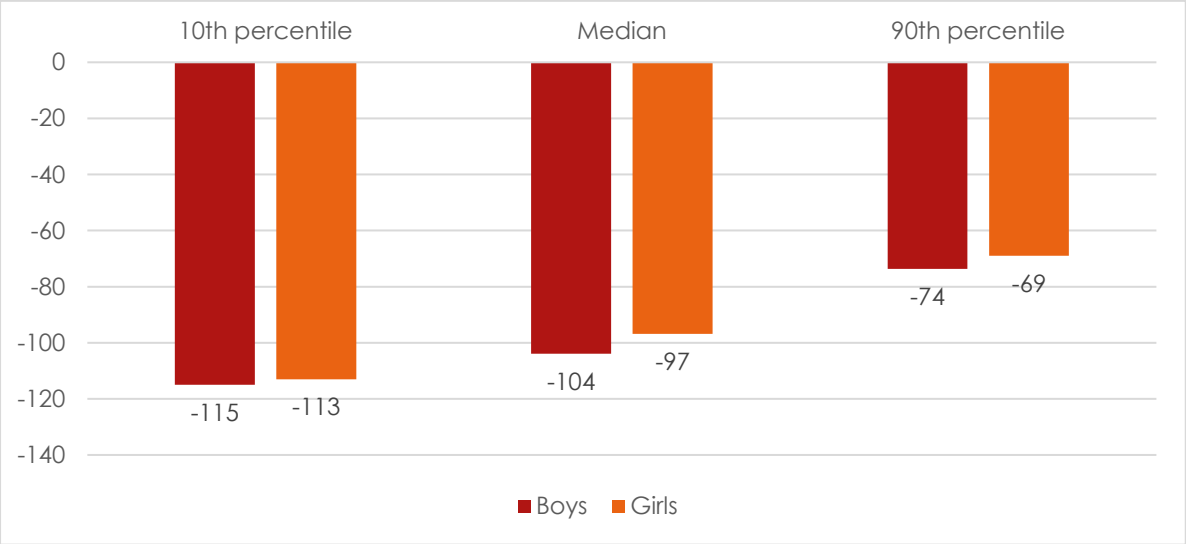
Source: Table A4.4 and Table II. B1.7.1, OECD, 2019.

Additionally, it is possible to check the differences between boys and girls in comparison to the OECD average among the top-, average- and poor-achieving students. As shown in figure 3.16, there are observable differences between boys and girls at different levels, and comparing the performance of Lebanese students to the OECD average it can be seen that the better achieving the students, the lower the achievement gap in relation to the OECD countries. The lowest-achieving Lebanese students scored more than 100 points less than those in the OECD countries at the same level, while the best-achieving students are only 70 points behind the OECD best students. Such an observation might be a result of the large inequalities observed in the Lebanese educational system rather than from gender disparities, since no significant difference was found between boys and girls at each of these proficiency levels. Thus, a deep analysis of the statistical differences connected to socioeconomic

status can be performed, in order to provide more information about the issues of Lebanese education.

Figure 3.16

Comparison of performance of Lebanese boys and girls across the mathematics score distribution against the OECD average



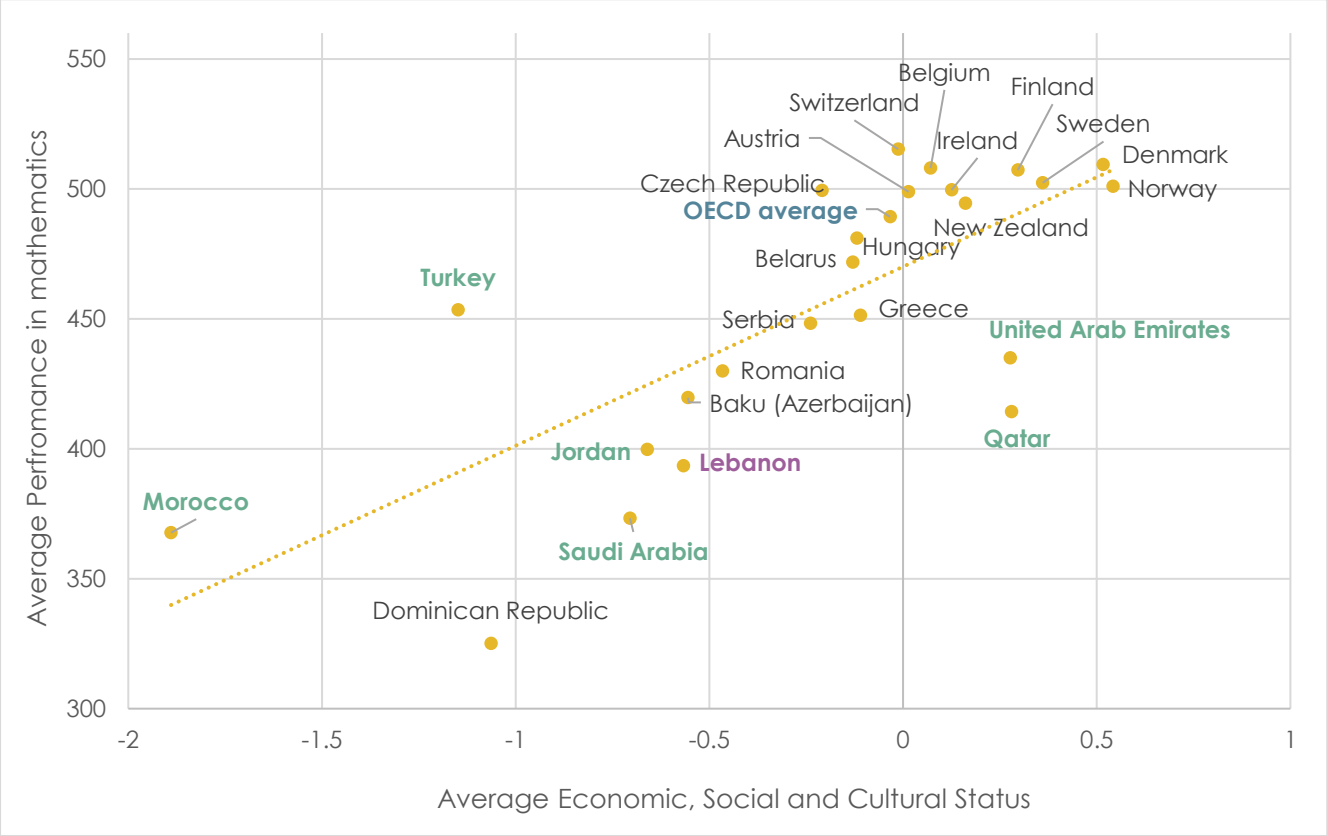
Source: Table A4.6, own calculations from the PISA database.

Social, economic, and regional contexts of mathematics performance

Socioeconomic status is a key variable when it comes to determining the differences in the achievements of students, since more affluent students have better access to healthcare and supportive tools for education. Even though the achievement gap caused by socioeconomic differences is almost impossible to cancel, the analysis of the educational systems and their relationship connected to one's affluence might provide key information on how these systems are fighting against the existing socioeconomic inequalities. Figure 3.17 shows how the performance in mathematics is dependent on the average Economic Social and Cultural Status (ESCS) of students at the country level. Based on the value of the R-square it can be observed that around 35% of the variation of mathematics performance is explained by socioeconomic status. The top-achieving countries, such as inland provinces of China, Singapore, and Poland, can be found above the trendline: in these countries, students scored higher than socioeconomic status predicted. At the same time, the poorest-achieving countries are placed below the trendline, which means that students from these countries and economies underperformed in mathematics, based on what socioeconomic status would have instead predicted. Interestingly, regional similarities can be observed, as countries from the same region can be found in close neighborhoods on the graph (i.e. Scandinavian countries, Western Europe). Lebanese students underperformed in mathematics, since according to their socioeconomic status their achievements could have been expected to be higher.

Figure 3.17

Mathematics performance and student socioeconomic background (ESCS index)

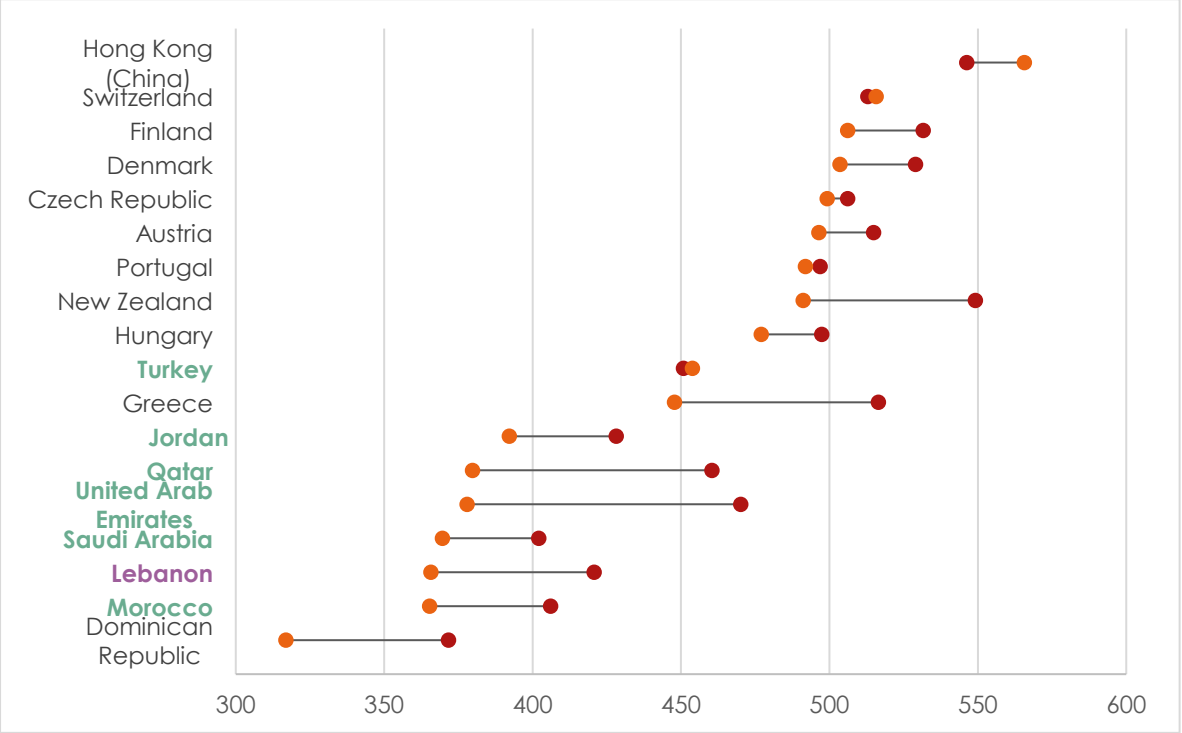


Source: Table II.B1.7.3, Table II.B1.2.1, OECD 2019

Figure 3.18 compares average achievements in mathematics in public and private schools. In the majority of the selected economies, pupils from private schools scored significantly higher in mathematics than their peers from public institutions. In Arabic states, these differences are high, and Lebanon, Qatar and the United Arab Emirates are characterized by the largest gaps. However, this difference is slightly smaller than in the case of reading, which can be partly explained by the fact that mathematics assessment is less dependent on extensive knowledge of the foreign language. The difference in the quality of teaching French and English languages between private and public institutions is substantial in Lebanon.

Figure 3.18

Difference in mathematics achievements between public and private schools



Source: Table II.B1.7.3, Table II.B1.2.1, OECD 2019

Chapter 4. Science performance of Lebanese students from an international perspective

Overview of the results

The performance of Lebanese 15-year-olds in science is 105 points lower than the result observed on average in the OECD countries. As the PISA assessment is a standardized large-scale assessment, with the mean equal to 500 points and standard deviation equal to 100 points, such drawback reflects a difference larger than one standard deviation. Based on the 95% confidence intervals, only in four countries and economies the average score in science was significantly lower than in Lebanon, while in Morocco, Georgia and Saudi Arabia students obtained results that are not statistically different from the one of Lebanon. In Indonesia, Kazakhstan, Baku (Azerbaijan) and Bosnia and Herzegovina the average results were also below 400 points, yet slightly higher than among Lebanese students. A full list of countries, classified based on their average score in science is presented in Exhibit 4.1

Exhibit 4.1

List of countries with results higher than, lower than, and similar to Lebanon.

Countries with lower average performance	Kosovo, Panama, Philippines, the Dominican Republic
Countries with similar performance	Morocco, Georgia, Saudi Arabia
Countries with performance higher by up to 50 points	Thailand, Uruguay, Romania, Bulgaria, Mexico, Qatar, Albania, Costa Rica, Montenegro, Colombia, North Macedonia, Peru, Argentina, Brazil, Bosnia and Herzegovina, Baku (Azerbaijan), Kazakhstan, Indonesia
Countries with higher performance but not above the OECD average	Portugal*, Norway, Austria, Latvia, Spain, Lithuania, Hungary, Russia, Luxembourg, Iceland, Croatia, Belarus, Ukraine, Turkey, Italy, the Slovak Republic, Malta, Greece, Chile, Serbia, Cyprus, Malaysia, United Arab Emirates, Brunei Darussalam, Jordan, Moldova
Countries above the OECD average	B-S-J-Z (China), Singapore, Macao (China), Vietnam**, Estonia, Japan, Finland, Korea, Canada, Hong Kong (China)*, Chinese Taipei, Poland, New Zealand, Slovenia, United Kingdom, the Netherlands*, Germany, Australia, United States*, Sweden, Belgium, Czech Republic, Ireland, Switzerland, France, Denmark

Source: Table A5.1 and Table I.B1.6, OECD, 2019a.

Note: *did not obtain PISA technical standards, **results not fully validated

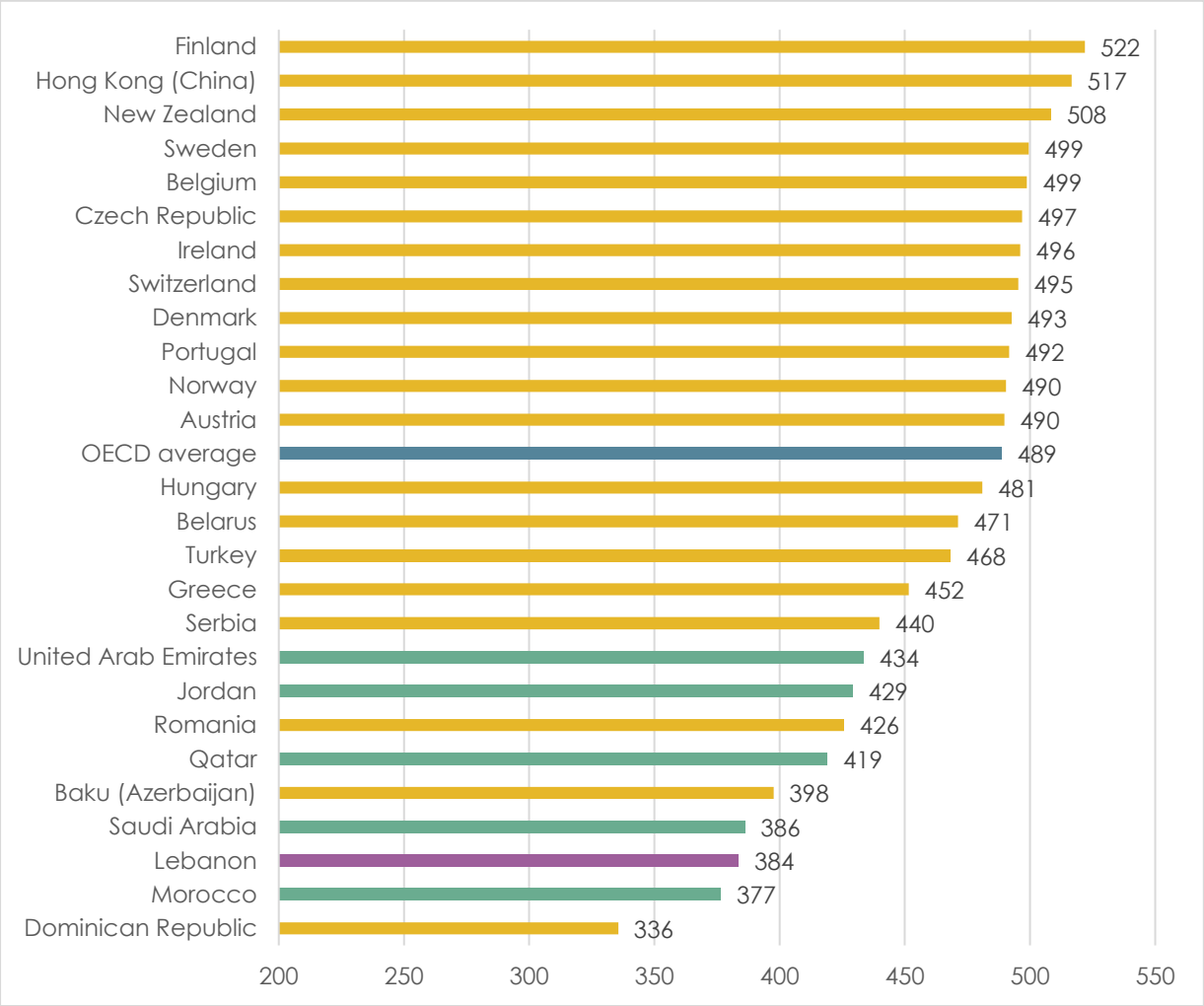
Figure 4.1 presents the average achievements in science in Lebanon and selected countries and economies. Just like in the case of mathematics, the inland provinces of China (B-S-J-Z, Macao Hong Kong), other Asian Tiger countries (Singapore, Republic of Korea, Chinese Taipei), two European Nordic countries (Estonia, Finland), Japan, and Canada were found at the highest places in the ranking. It is worth mentioning that the performance of students from B-S-J-Z province has reached values which are basically incomparable to any country or economy

participating in the PISA assessment. Their score exceeded the performance of the average Singaporean student, who was placed in second place, by almost 40 points. In other top-performing countries, the average results did not vary, as between the 2nd and 10th countries in the ranking there was only a 30 points difference. However, it can be noted that Macao and Singapore figures are slightly higher than the rest of the high-achieving countries. Only in 18 out of 78 countries and economies[4] the average score in science was higher than the standardized mean equal to 500 points. On the contrary, in the least affluent Middle Eastern and North African (Morocco, Saudi Arabia and Lebanon), Asian (Philippines), American (Dominican Republic) and post-communist countries (Kazakhstan and Baku) the average performance was the lowest among the participating countries. Interestingly, the performance of Lebanese students was fairly lower than in countries from the closest neighborhood such as Jordan, Cyprus, Turkey, Qatar and the United Arab Emirates. It is worth mentioning that Lebanon was found in a group of countries where the average score was lower than 400 points.

[4] Vietnam participation was not included, as the OECD could not assure full comparability of the results.

Figure 4.1

Comparison of average science scores in Lebanon and selected countries and economies



Source: Table A5.1 and Table I.B1.6, OECD, 2019a.

As mentioned in the previous chapter, the mean score is an imperfect estimation of the result achieved by the student of a given country, as the outliers can strongly bias it. Thus, employing other measures such as the percentage of students who were found at different proficiency levels might provide better and more meaningful insights into the understanding of the drawbacks of the Lebanese educational system. To provide a more informative analysis, the distribution of 15-year-olds at different proficiency levels from Lebanon was compared to the OECD average. The results are shown in figure 4.2.

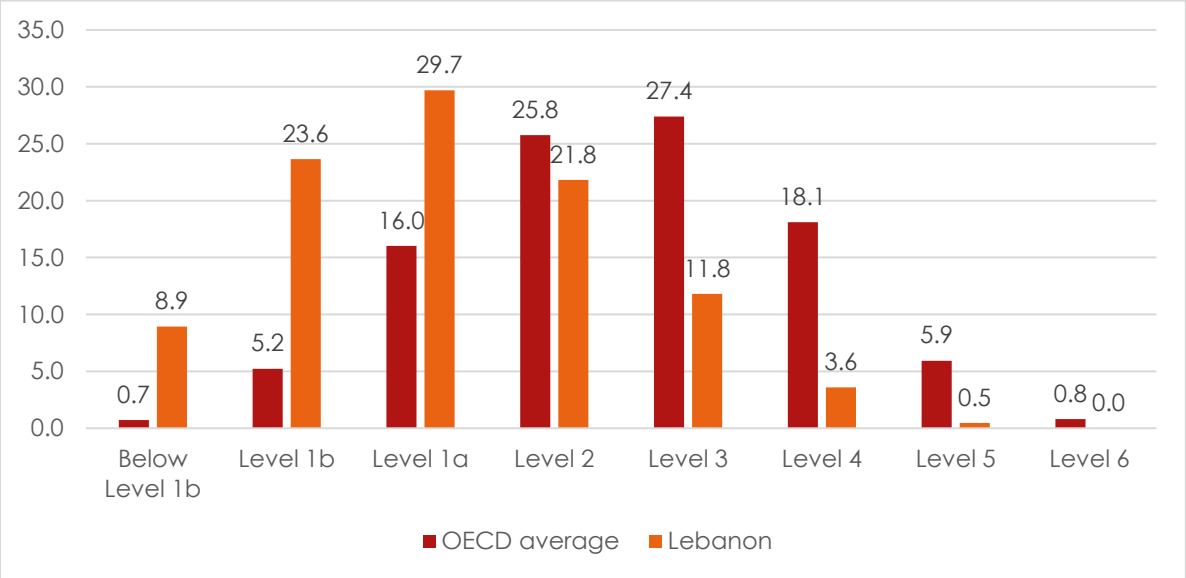
The distributions of students are fairly different between Lebanon and the OECD countries. While in the OECD countries 52.3% of pupils reached a second or third level, in Lebanon only 1/3 managed to do so. In the OECD countries, around 20%

of students did not reach level 2, while almost 2/3 of Lebanese students did not reach it, which is described as the most elementary knowledge of scientific facts. Such observation suggests that more than half of Lebanese students do not have enough competencies and knowledge that will enable them to understand the world of nature, based on the simplest scientific facts. In terms of the highest levels of proficiency (level 5 and 6), less than 1% of Lebanese students reached it, while around 7% of the OECD students did.

These distributions suggest that Lebanon's low performance in the PISA assessment results from the underperformance of students below level 2. Hence, implementing a policy-based analysis of the sources of the low performance of the most disadvantaged students might provide key answers on how to improve the Lebanese educational system.

Figure 4.2

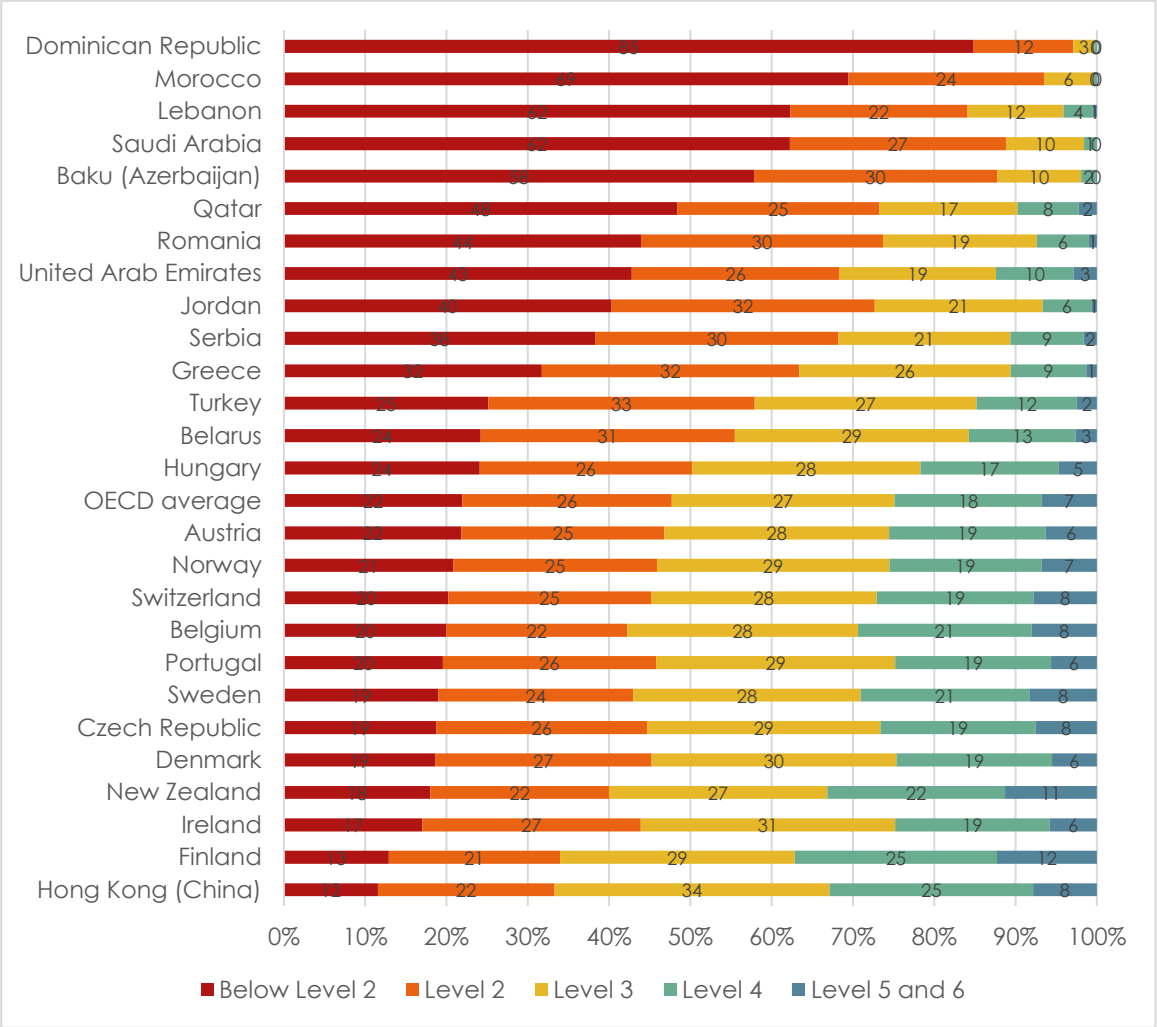
Percentage of students at different science-proficiency levels in Lebanon and across the OECD countries on average



Source: Table A5.2 and Table I.B1.1, OECD, 2019a.

Figure 4.3

Science-proficiency level distributions across selected countries



Source: Table A5.2 and Table I.B1.1, OECD, 2019a.

A comparison of the performance of Lebanese students with the ones from the different countries participating in the assessment is shown in figure 4.3. Since there are no large differences between the levels below 2 and 5 and 6, for the sake of clarity these levels have been merged.

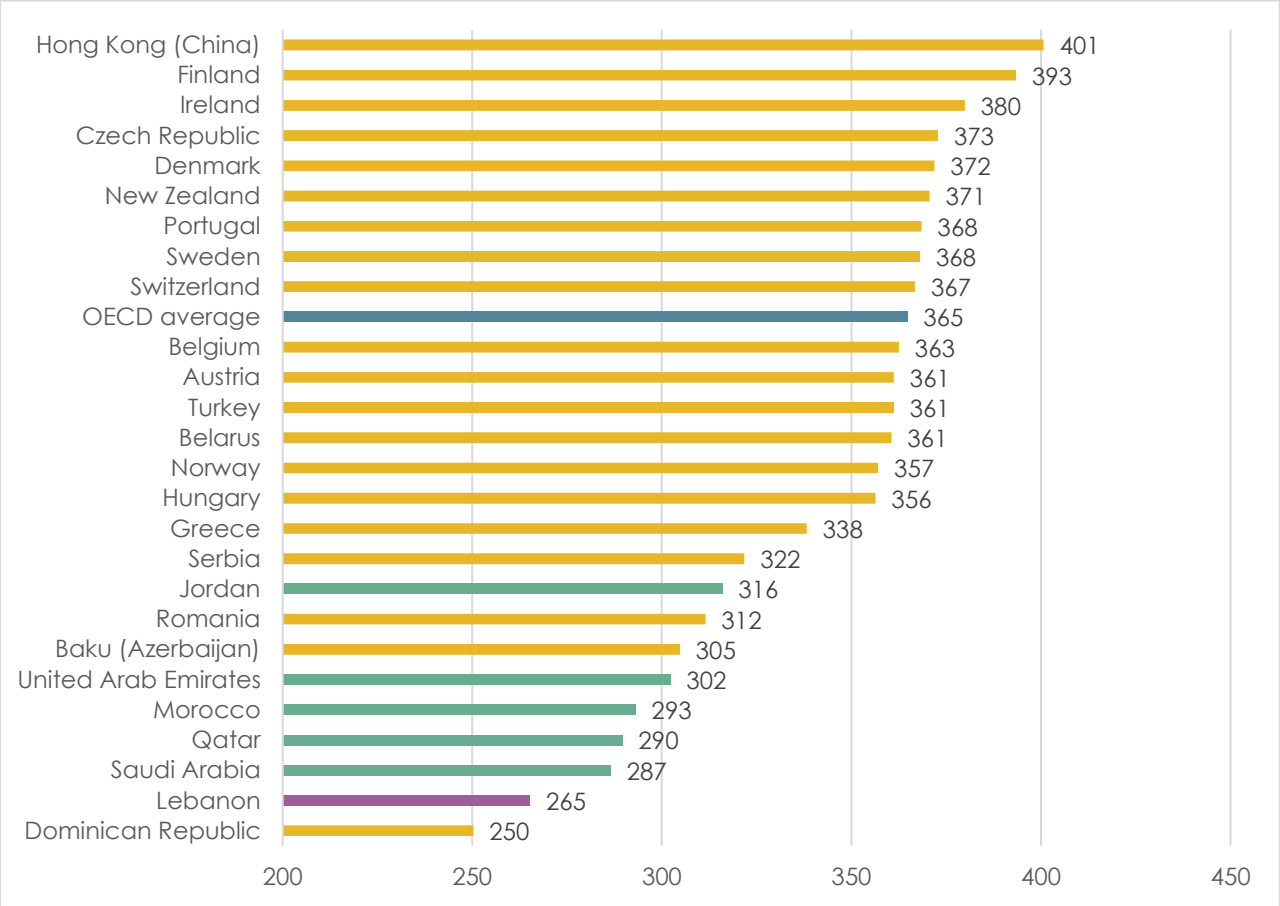
In most countries, more students did not reach level 2 than on the OECD average. Among the poorest-achieving countries, such as the Dominican Republic and Morocco, less than 1/4 of students reached level 2 or higher. It is worth mentioning that in the most successful countries and economies, around 10% of students did not receive enough points to reach level 2. At the same time, the majority of students from top-achieving countries were found at the 3rd and 4th level of proficiency in science..

In countries more similar to Lebanon, such as Jordan and Qatar, considerably more students succeed in reaching level 2 in science proficiency, while in Morocco slightly more students than in Lebanon had significant difficulties in science. In conclusion, the performance in science of Lebanese 15-year-olds can be regarded as low among the OECD countries, as well as among the neighboring and similar countries.

As mentioned in previous chapters, low performance in the country or economy may result from the underperformance of the lowest-achieving students. The lowest-achieving students usually come from less affluent households and have worse access to higher education and health care. Additionally, the inflow of refugees from Syria and Palestine has strongly influenced the educational system's problems (El-Ghali et al., 2019). Figure 4.4 compares the achievements of students in the 10th percentile across selected countries. The position of these students is quite low, as Lebanon can be found in 76th place out of 79 surveyed countries and economies, with a score lower by 120 points than the mean. Only in the Dominican Republic students achieve lower results than in Lebanon, since the difference with the performance of students from the Philippines is not statistically significant.

Figure 4.4

Comparison of performance of low-achieving students in Lebanon and selected countries (10th percentile of the science-performance)

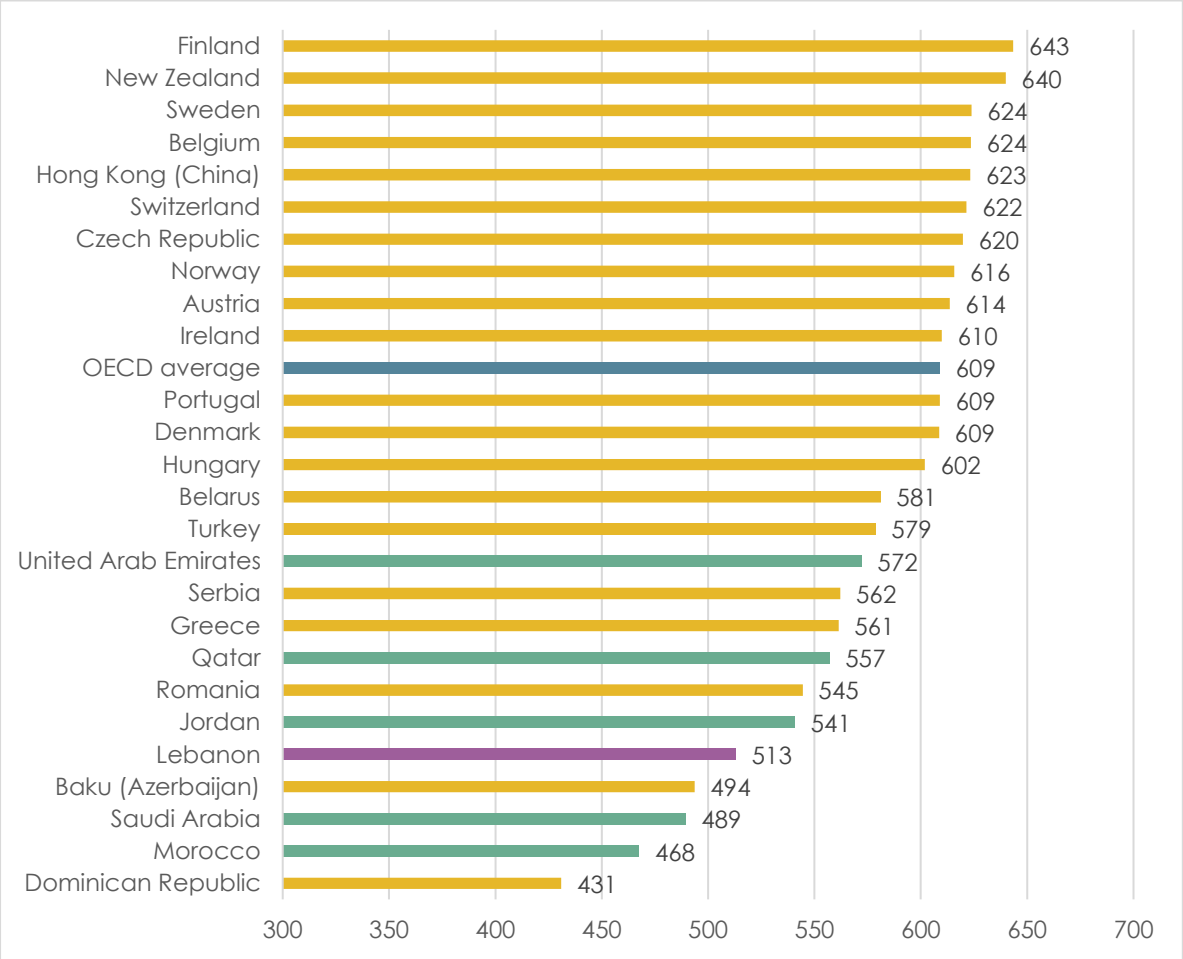


Source: Table A5.3. Own calculations from the PISA database.

For the sake of comparison, figure 4.5 presents the science performance of the highest achieving students across selected countries and economies, the ones in the 90th percentile. At the highest positions, it is possible to see roughly the same countries and economies as in the previous rankings, namely Hong Kong, Finland, Sweden, where students have scored more than 620 points on average. In Lebanon, the average score of the best students was equal to 513 points, which is 129 points higher than the Lebanese mean, yet only 24 points higher than the OECD average performance. If the PISA 2018 assessment focused only on the performance of the highest achieving students, then Lebanon would have increased its position in the ranking by 7 positions. These observations are consistent with the findings from the previous chapters, namely that the low performance of Lebanon in the science assessment is significantly influenced by the low-performing students.

Figure 4.5

Comparison of performance of high-achieving students in Lebanon and selected countries (90th percentile of the science performance)

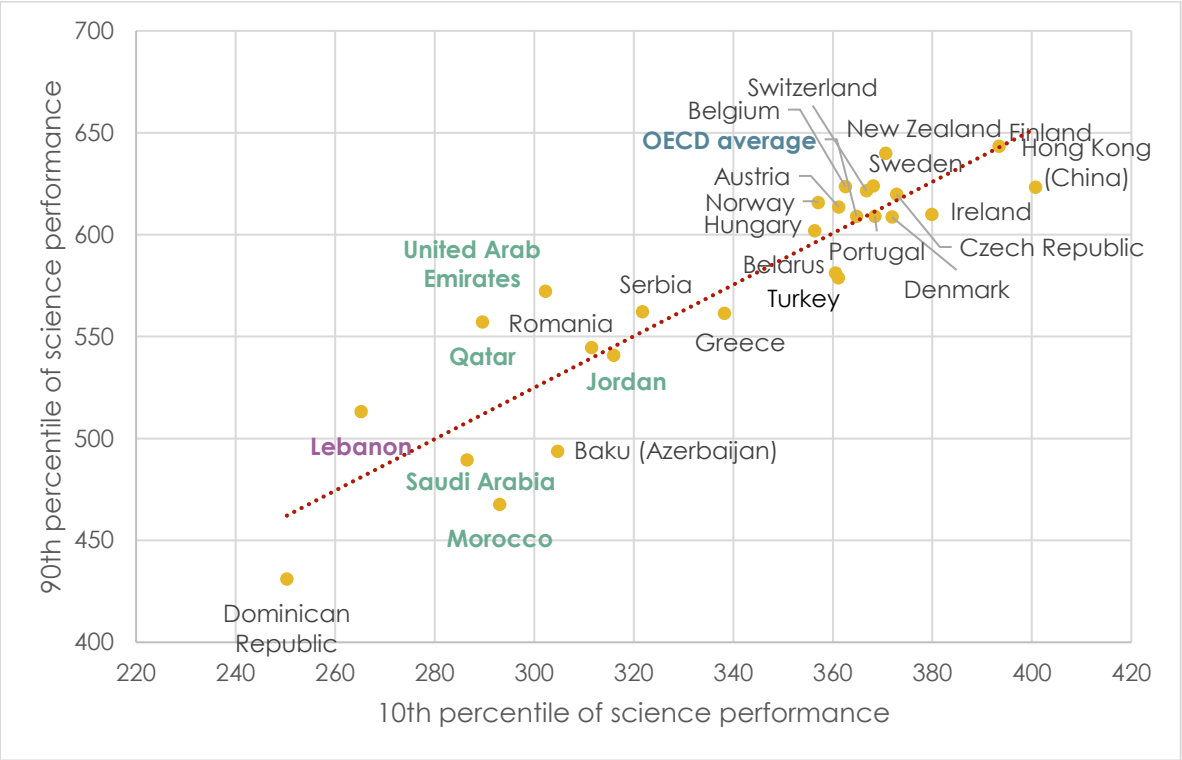


Source: Table A5.3. Own calculations from the PISA database.

Figure 4.6. shows the relationship between the performance of the top-achievers and low-achievers, which is quite strong, since the R-square indicates that the low-achievers performance explains almost 83% of the variation of the top-performers score. Countries that are found above the trendline are described as those with a comparatively high performance of high-achieving students, while those below are characterized by a comparatively low performance of low-achieving students. Lebanon can be found slightly above the trendline, which means that based on the performance of low-achieving students from Lebanon, the score of the top-performing students was expected to be lower. The position of high-achieving countries in relation to the trendline vary, as Hong Kong can be found below the trendline, while in Switzerland it is instead observed above the trendline.

Figure 4.6

The relative performance of low- and high-achieving students (10th and 90th percentiles of science performance)

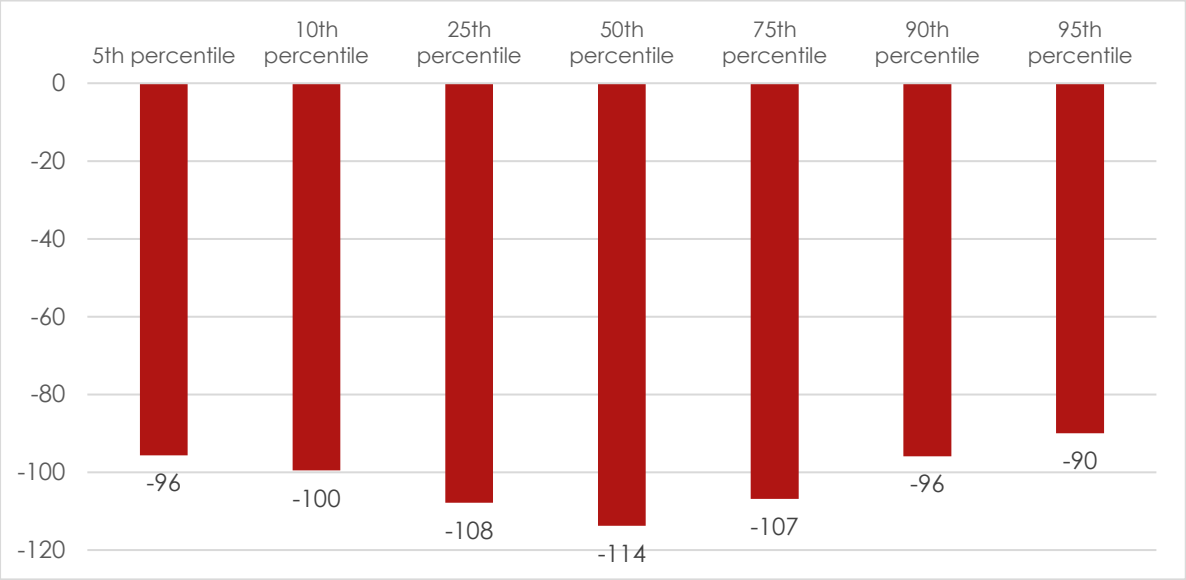


Source: Table A5.3. Own calculations from the PISA database.

Figure 4.7 presents the achievements gaps between Lebanese and the OECD students at different science performance distribution levels. Differently than in the case of reading and mathematics, the achievement gap between Lebanon and the OECD countries is more visible among the average-performing students. It can be seen that Lebanese students who were found at the 50th percentile scored 114 less points than their peers from the OECD countries in the same category. Nevertheless, there are considerably large differences between the OECD and Lebanese students, as at each percentile students from Lebanon have a score which is one standard deviation lower than the one of students from the average OECD country. In the further process of education, such differences might cause difficulties in obtaining a quality degree and transiting into STEM professions.

Figure 4.7

Comparison of performance of Lebanese students across the science-score distribution with the average performance of the OECD



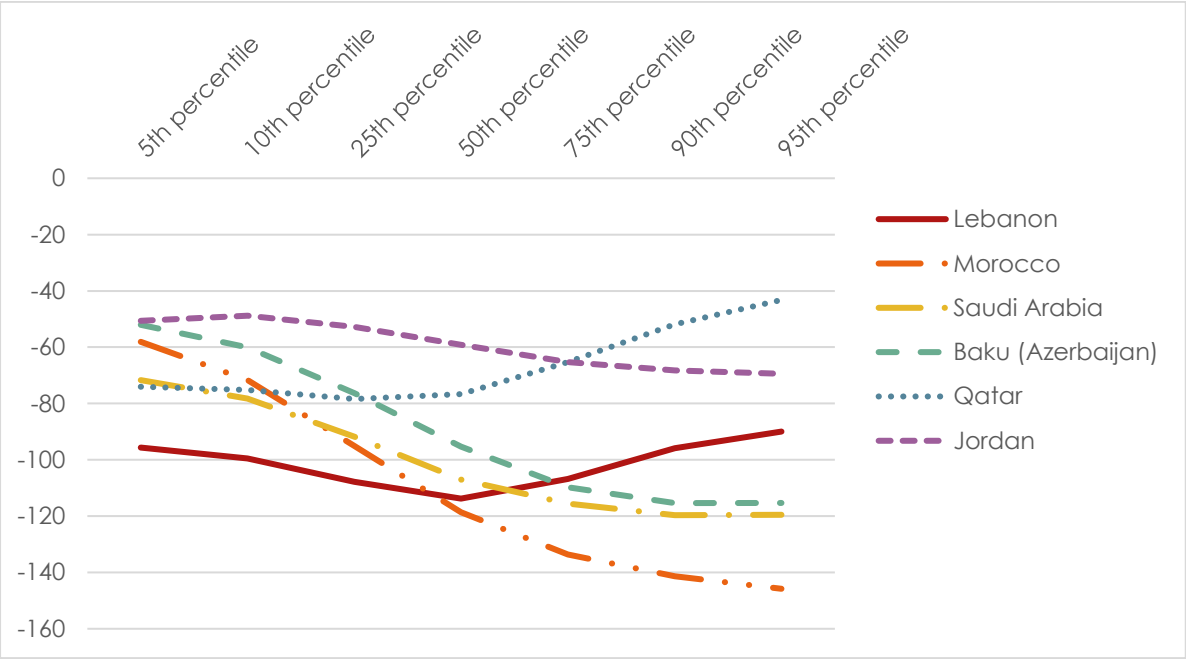
Source: Table A5.3. Own calculations from the PISA database.

As some patterns might be observed at similar levels or be occurring in countries which are similar in terms of economic, social and cultural development, it is worth comparing the science achievement gaps in Lebanon and other countries. Five benchmark countries were chosen due to their geographical or cultural closeness to Lebanon, namely Morocco, Saudi Arabia, Baku (Azerbaijan) Qatar and Jordan. Figure 4.8 provides a detailed analysis of the differences between the selected countries and the OECD average. In Jordan, Baku, Saudi Arabia and Morocco, poor-achieving students are closer to the average OECD country in comparison to the most talented students, yet these differences vary. In Jordan and Saudi Arabia, there is a slight increase in the gap achievement, while in Baku, there is a moderate increase in the gap achievement. The largest growth of the achievements gaps through different performance levels is observed in Morocco, where the gap more than doubles. The only country of the sample which can be somehow comparable to Lebanon in terms of the gap between the OECD average and the performance of students is Qatar, where the largest differences are found among the low- and average-achieving students. Yet, it is a country which differs substantially from Lebanon in terms of economic development and stability. Moreover, the performance of the low-achieving students in Qatar and Lebanon is the lowest among selected countries,

while the students who reached the 95th percentile in Qatar, Jordan and Lebanon are the ones whose performance differs the least from the OECD average.

Figure 4.13

The gap between the OECD average and science performance at different percentiles for selected countries

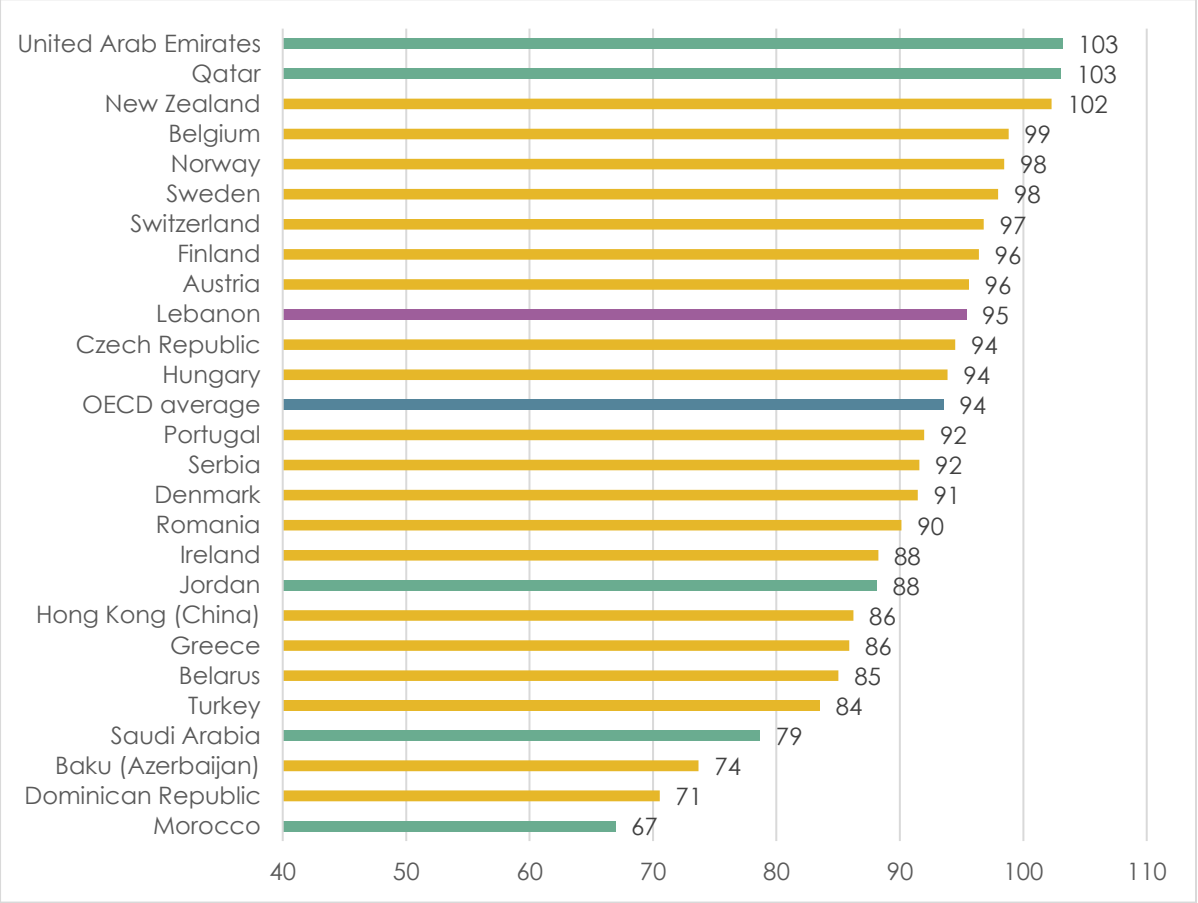


Source: Table A5.3. Own calculations from the PISA database.

Another essential statistical measure that can provide insights into the understanding of the performance of Lebanese students in science is the standard deviation of the achievements, since the higher the standard deviation is, the more the results are spread around its mean, indicating more heterogeneous results. Figure 4.9. shows the estimates for the standard deviation of the performance of students.

Figure 4.9

Variations in student performance



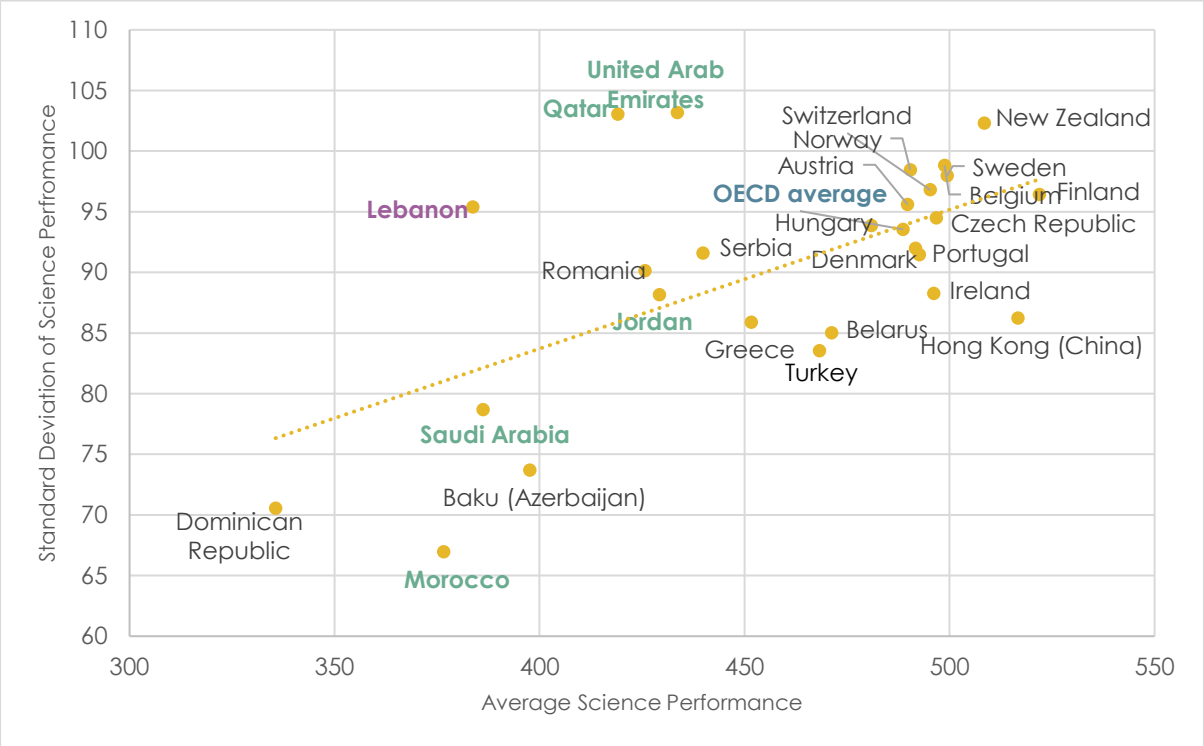
Source: Table A5.3. Own calculations from the PISA database.

The OECD average is equal to 94 points, which is only one point lower than the variation of Lebanon, with no statistically significant difference between these values. There is no noticeable pattern in terms of the variation of the science performance of the highest-achieving countries and economies, since even though the New Zealand and Belgium have scored high in the PISA assessment, their position in the ranking of variance is similar to the position of lower achieving countries, such as Qatar and the United Arab Emirates. At the same time, the most successful economies such as the Hong Kong and Ireland exhibit one of the lowest standard deviations among the selected countries. Furthermore, there are countries and economies whose standard deviations stand out as it was smaller than 70 points, such as Morocco and the Dominican Republic.

Figure 4.10. shows the relationship between the mean and the standard deviation, though it can be seen that the mean score does not serve as a sound approximation of the standard deviation of the results in science. Based on the Z-score outlier determination, it can be found that Qatar and the UAE can be regarded as outliers when it comes to the analysis of the properties of the trendline, and if these observations are removed, the R-square would increase to 39%. In conclusion, based on the results of the 15-year-olds from the selected countries, there is no reason to determine a significant relationship between the variance and mean results.

Figure4.14

Average scores in science and differences between students (variation)



Source: Tables A3.1 and A3.3.

However, the large disparities from the trendline might also provide information about the educational inequalities observed in the selected countries. Indeed, when looking at the assessment outcomes of 15-year-olds from Qatar and the UAE, enormous disparities between the low-achieving and high-achieving students can be observed. On the contrary, in Finland students were similar, and the range of differences between high and low-achieving students was rather low, resulting in low variation in science achievements.

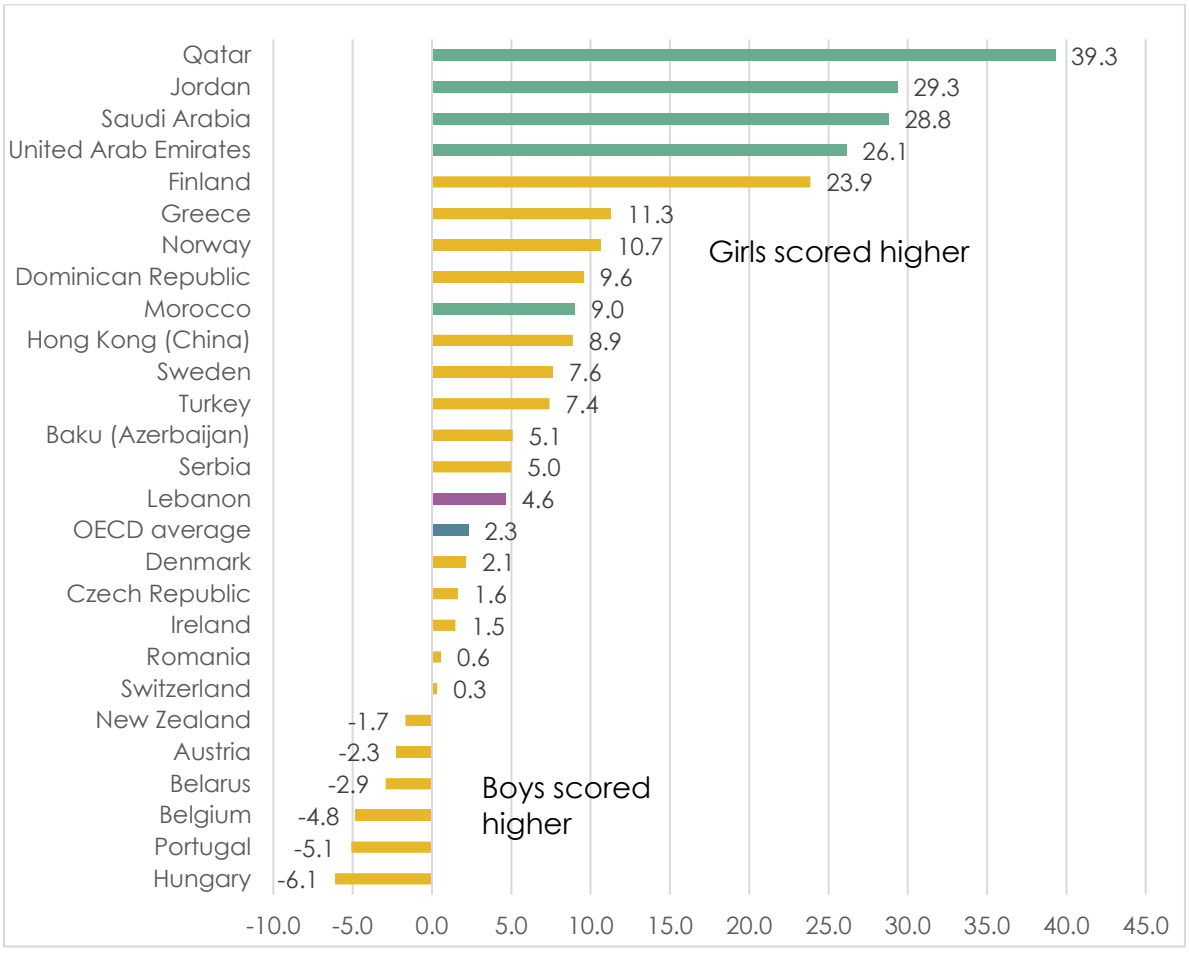
Gender gaps in science achievements

In the previous chapters, the gender gaps in reading and mathematics were discussed in terms of Lebanese and international students. The evidence has shown that girls performed better in reading than boys, while boys slightly outperformed girls in mathematics. Except for the reading assessment, gender gaps in the achievements of students are quite low in Lebanon, and they are among the lowest in the neighboring countries and in the whole PISA sample.

Figure 4.11 compares the science achievements of boys and girls from selected countries and economies. The gender gap in this case has been defined as the difference in the scores obtained by girls and boys obtained during the PISA science assessment, meaning that the higher the gender gap, the more girls outperformed boys. In the OECD countries the gender gap remained positive albeit small. However, the outperformance of girls is statistically different from zero. Among the top-performing countries, the gender gap strongly varies. In the Hungary, boys received slightly better results when compared to girls, while 15-year-old girls from Finland and Hong Kong significantly outperformed boys. There was almost no gender gap in New Zealand science achievements. The same pattern applies to the poorest-achieving countries, as in Qatar and Jordan girls strongly outperformed boys, while in Belarus boys were better at science than girls. Thus, the average score obtained in the science assessment seems not to influence the scope of the gender gap, based on the correlation. The observed gender differences are more likely to be resulting from other factors such as access to education and income levels. In Lebanon, the gender gap is larger than the OECD average. Girls scored around 5 more points than boys in the science assessment. Due to the large variation in the average scores of students in Lebanon, the achievement gap was not statistically significant, and in any case it was considerably low when compared to the ones of the neighboring countries.

Figure 4.11

Gender gap in science achievement (performance advantage of girls over boys)



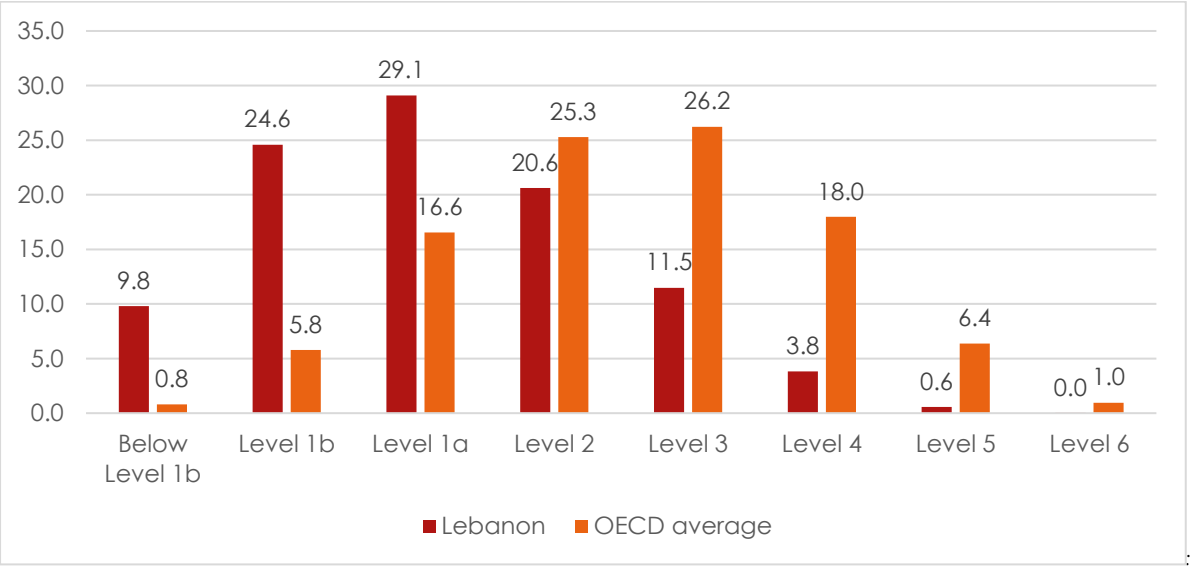
Source: Table A5.4 and Table II.B1.7.1, OECD, 2019c.

Figures 4.12 and 4.13 compare the distributions of the proficiency levels in science in Lebanon and the OECD countries, respectively, among boys and girls. In the OECD countries more than 50% of all boy students reached either second or third level of proficiency, which should be interpreted as possessing the most basic knowledge and competencies concerning the world of chemistry, biology, physics and earth science. On the contrary, in Lebanon more than half of the boys could not score enough points to reach level 2. Only 36.5% of Lebanese boys were found at a level higher than 1a, which suggests huge drawbacks in the Lebanese educational system. It is worth mentioning that when it comes to the most advanced levels, less than 1% of boys were found in that category both in Lebanon and on the average OECD country, yet in the latter case the observed share of students was consistent with the properties of a normal distribution. As these levels are described as the most

advanced, one may consider the possibilities of students pursuing a career in the STEM fields, which can instead be very difficult for Lebanese students.

Figure 4.12

Science-proficiency level distribution among boys in Lebanon compared to the OECD average distribution for boys

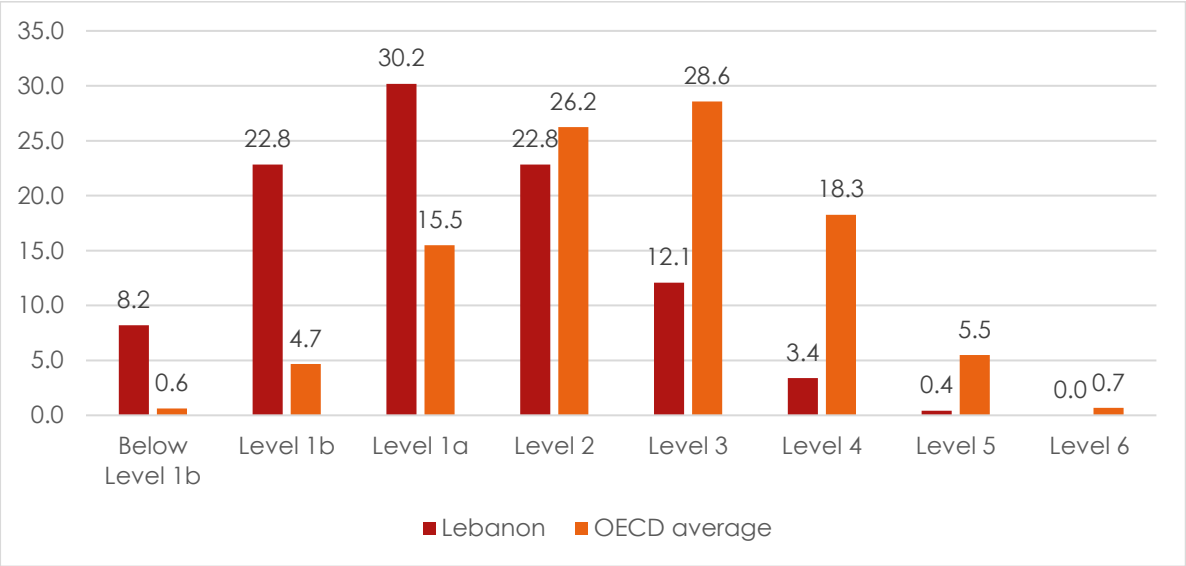


Source: Table A5.5 and Table II.B1.7.2, OECD, 2019c.

Interestingly, the distribution of 15-year-old girls from Lebanon and the OECD countries is slightly different from the ones described above. Among Lebanese as well as average OECD girls, one can observe that slightly less girls can be found on levels 5th and 6th in Lebanon than in the average of the OECD countries. At the same time, the share of girls at the least advanced levels is slightly smaller in Lebanon than in the average of the OECD countries. Nevertheless, the distribution of Lebanese girls' performance in science is barely comparable to the average OECD girls, which is similar to the case of the boys.

Figure 4.13

Science-proficiency level distribution among girls in Lebanon compared to the OECD average distribution for girls



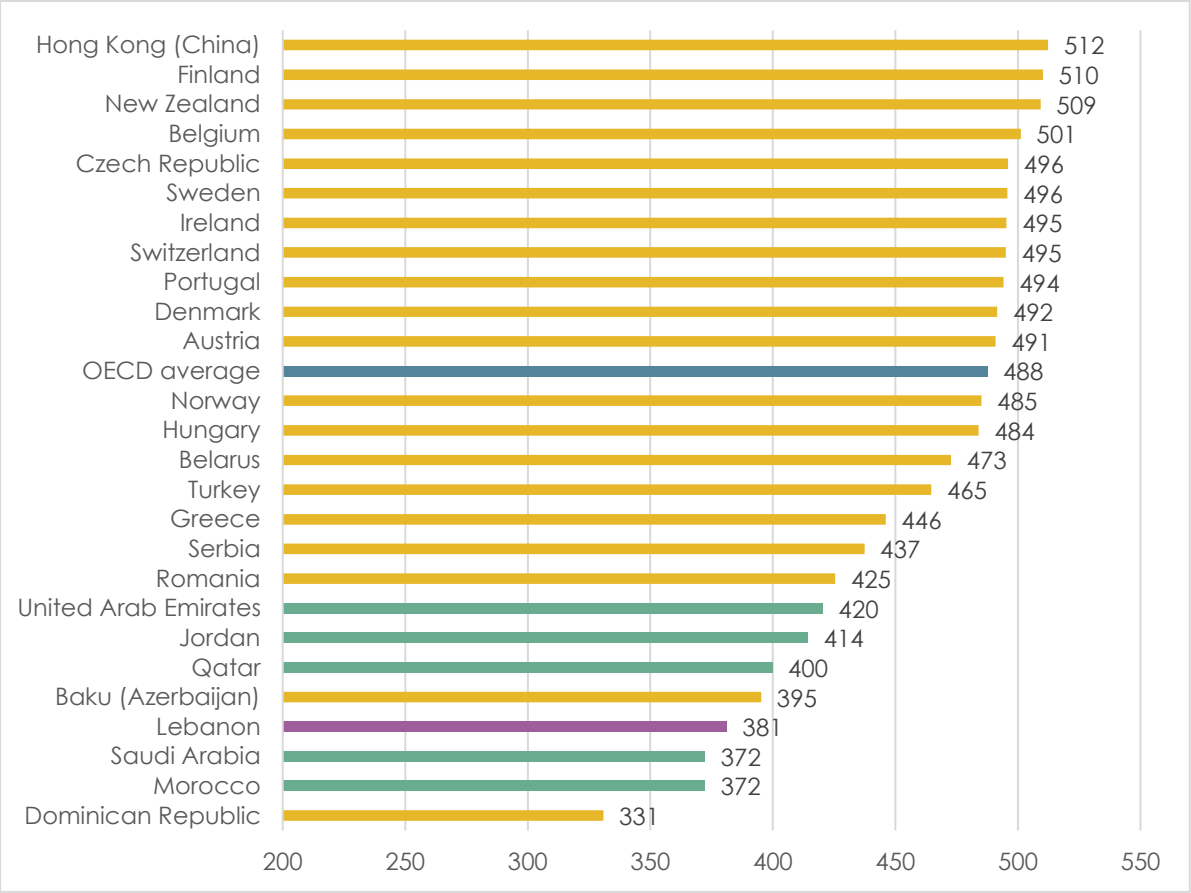
Source: Table A5.5 and Table II.B1.7.2, OECD, 2019c.

Figures 4.14 and 4.15 compare the average scores obtained by respectively boys and girls across selected countries and economies. As shown before, the proficiency levels differ significantly between Lebanon and the other countries and economies participating in the assessment. However, it can be seen that the gender gap in the science assessment is smaller compared to reading and mathematics. Hence, for the sake of brevity, only the differences found in the Lebanese educational system will be discussed.

Even though the gender gap was in favour of girls, boys were placed higher in the international rankings. Lebanese 15-year-olds were found at 7th lowest position, while there were only five countries and economies where the performance of girls was lower than in Lebanon. It is worth mentioning that the countries found below Lebanese boys are generally regarded as poor achievers in science. Hence, the difference in the positions of boys and girls in the rankings does not provide insightful information about the drawbacks of the systems.

Figure 4. 14

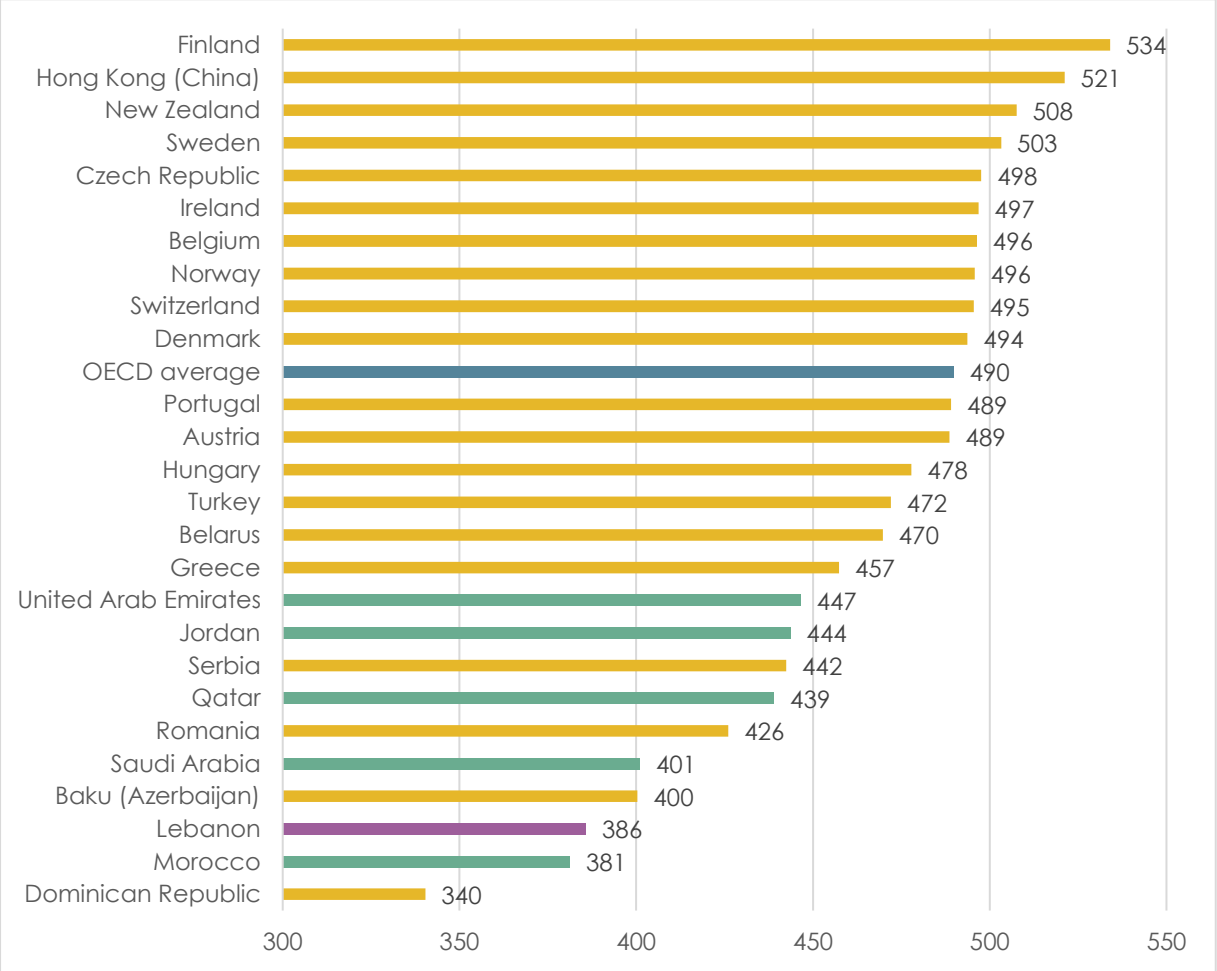
Science performance of Lebanese boys compared to selected countries and economies



Source: Table A5.4 and Table II.B1.7.1, OECD, 2019c.

Figure 4.15

Science performance of Lebanese girls compared to selected countries and economies



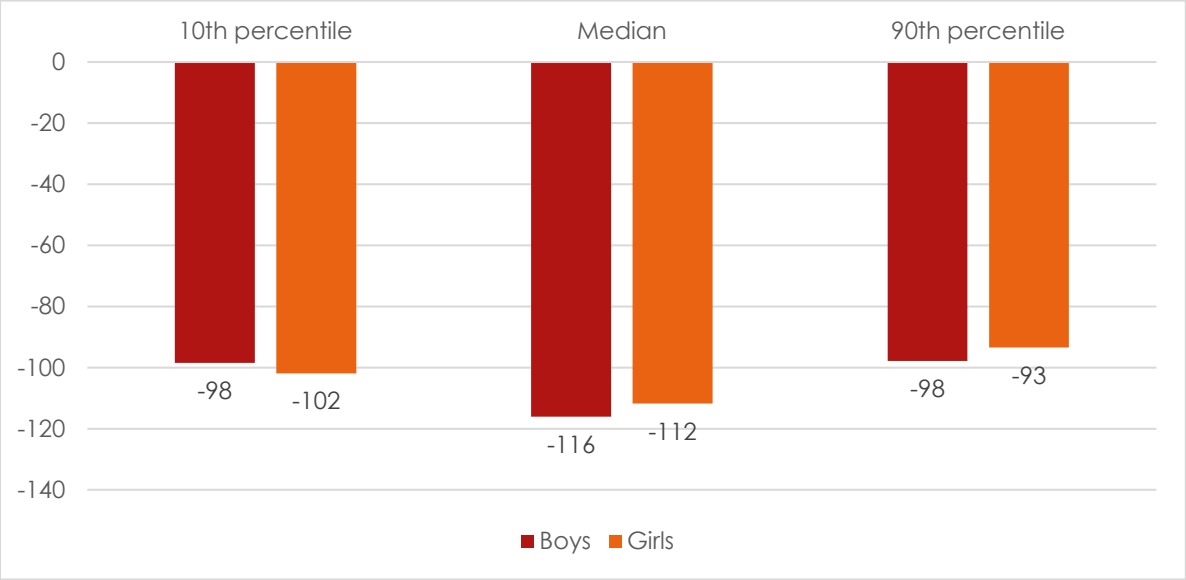
Source: Table A5.4 and Table II.B1.7.1, OECD, 2019c.

Figure 4.16 compares achievement gaps among low- (10th percentile), average- (50th percentile), and high-achieving (90th percentile) boy and girl students in Lebanon and the OECD countries. Even though small differences in achievements can be found at different distribution levels, the statistical estimations found these differences to be insignificant. However, a few conclusions can be nonetheless drawn. Among boys, the differences for poor- and high-achieving students are the same, while the achievement gap at the median level is even lower. On the contrary, the girls' achievements gaps substantially decrease among the high-achieving students. The achievement gap between Lebanese and OECD girls decreases by 5 and 19 points in comparison to respectively poor- and high-achieving girls. Nevertheless, the observed differences are consistent with the previous analysis, since

the more substantial differences between Lebanese and the OECD students are observed among the average-achievers, despite their gender.

Figure 4.16

Comparison of performance of Lebanese boys and girls across the science-score distribution against the OECD average



Source: Table 5.6, own calculations from the PISA database.

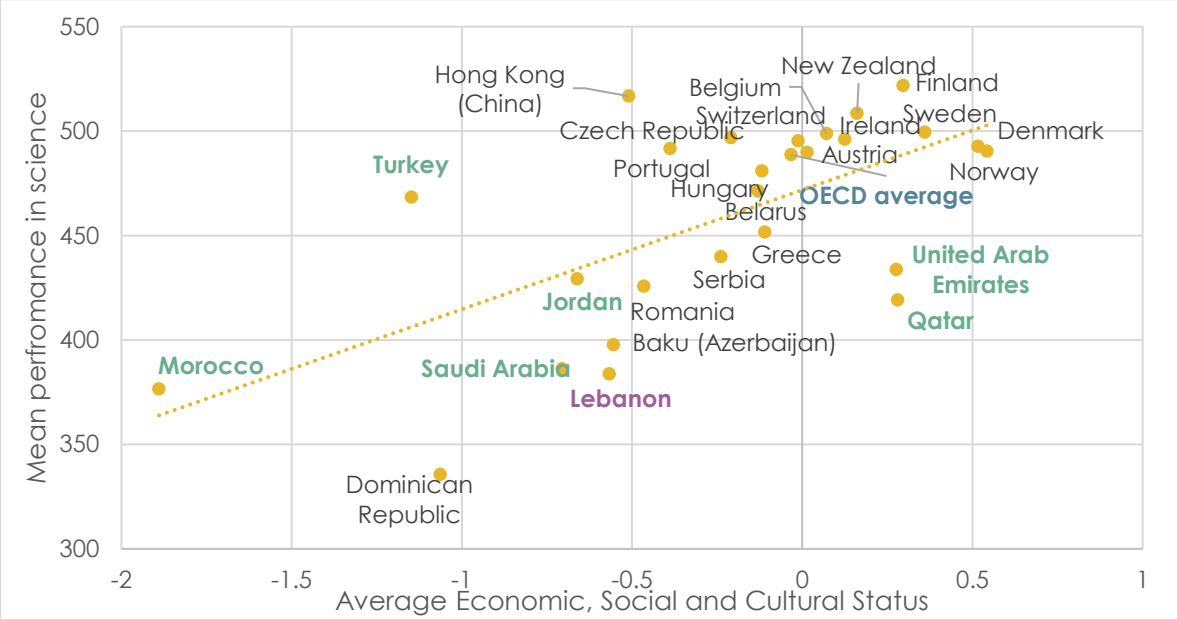
Social, economic and regional contexts of science performance

As described in chapters 2 and 3, the student's socioeconomic status was proved to substantially impact the achievements in the PISA assessment in reading and mathematics. The influence of affluence among individuals is impossible to fully neutralize, yet some educational systems are succeeding in handling inequalities. Lebanon presents large inequalities between students on different socioeconomic levels but also a significant role for the private sector, which may further impact them. Moreover, the inflow of Syrian Refugees, the Covid-19 pandemic, and the Port of Beirut explosion have strongly affected Lebanon's ongoing socioeconomic status crisis (World Bank, 2021) and may also delay needed investments. The average human capital index is also fairly low, as it was estimated that students born today are expected to reach only 52% of their potential.

Figure 4.17 compares the average performance in science and the Economic, Social and Cultural Status index among selected countries and economies. The ESCS is a standardized measure proposed by PISA which reflects the average status of the country such that if the index value is larger than 0 in absolute value then the ESCS is higher in the selected country compared to the average of the other OECD countries. Across selected countries and economies, the ESCS index explained 34.41% of the variation in the science performance, based on the R-squared statistics.

Figure 4.17

Science performance and student socioeconomic background (ESCS index)

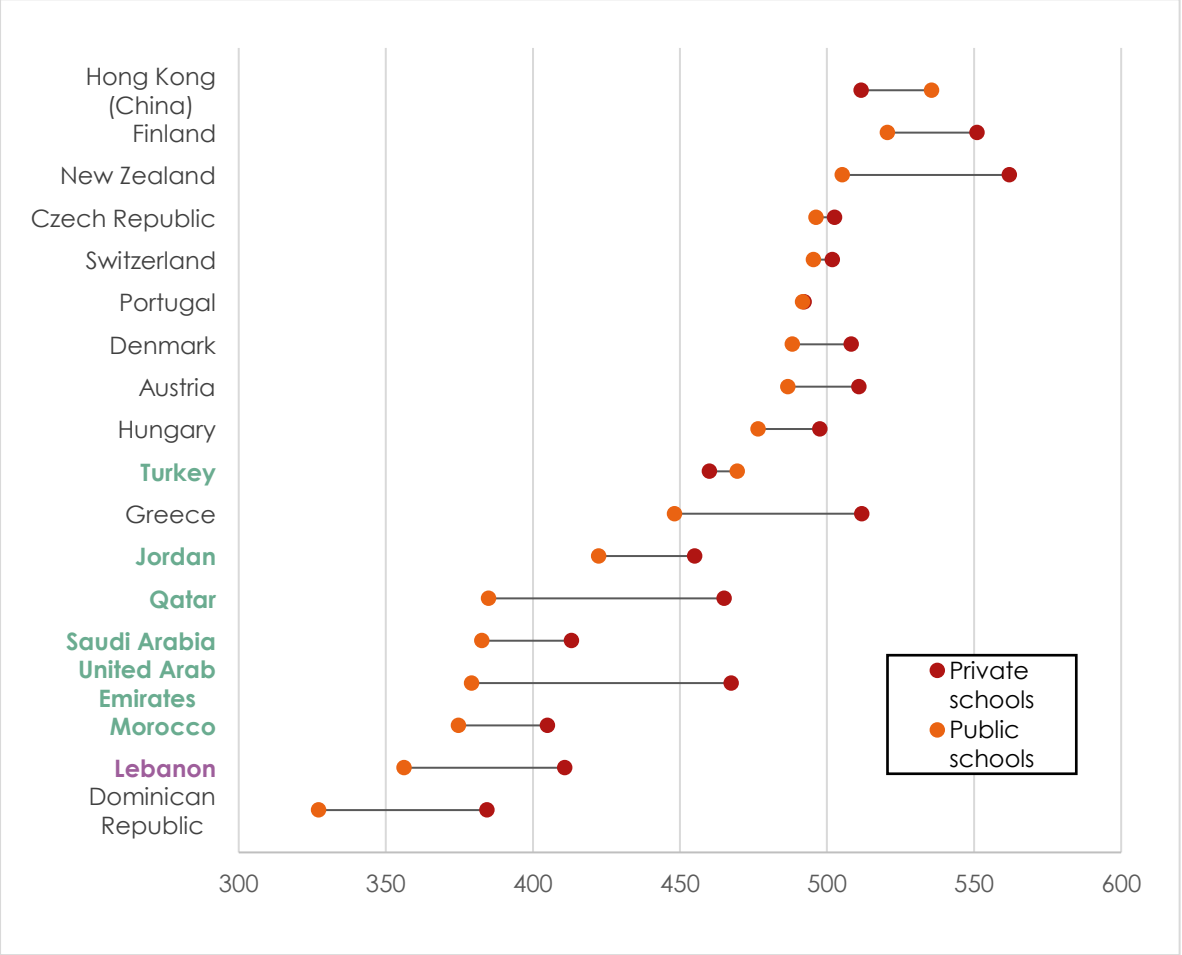


Source: Table A5.1 and Table II.B1.2.1., OECD, 2019c.

The countries found above the trendline are economies where the average science performance is higher than it can be expected based on the ESCS index of the economy. The provinces of China were found to be strongly outlying from the trendline, since students from Hong Kong scored more than 100 additional points than what the model estimated. Interestingly, Saudi Arabia and Lebanon show a similar ESCS index; however, the average performance was lower in these economies by 50-100 points compared to the trendline. These observations are consistent with the findings from chapters 2 and 3, as Lebanese students did not reach the trendline, meaning that possibly the current educational system devotes insufficient expenditures on education and do not properly support the most disadvantaged students (World Bank, 2021).

Figure 4.18

Difference in science performance between public and private schools



Source: Own calculations based on PISA 2018 microdata

Figure 4.18 compares achievements of students from public and private schools in selected countries and economies. Among these states, only in Hong Kong pupils from public institutions outperformed their peers from private schools. In Arab states, the differences are high, just as discussed in terms of mathematics and reading. In Lebanon the gap between students is high, yet smaller than in Qatar and the UAE. It is estimated that, students from private schools scored around 55 points more in science than students from public schools. However, this result needs to be interpreted cautiously since the offer of private schools in the country is extremely broad and a large variance between them may exist.

Chapter 5. Future challenges for the Lebanese educational system

Using data from the 2018 PISA assessment, we evaluated the performance of students in Reading, Mathematics, and Science. Moreover, for each subject we compared the attainments of Lebanese students with the ones of the other participating countries, with a particular focus on the countries which either geographically or culturally neighbor Lebanon. In addition, we investigated the characteristics of the gender gap in achievements and the social and economic factors which might impact performance.

Our findings, presented in the previous chapters, are that the Lebanese educational system still experiences several challenges which strongly impair the performance of students. First, educational achievements are usually low, and Lebanon ranks among the lowest achieving countries and economies which participate in the PISA assessment. Second, we found evidence of a gender gap, whose direction appears to be dependent on the subject of study: while in the case of reading girls appear to outperform boys, the opposite happens in the case of mathematics. However, the differences between boys and girls hardly ever deviate from the OECD average. Third, and possibly most importantly, we found that the socio-economic context in which students live has a strong impact on their performance. In particular, the poor social and economic context generates students whose performance is so poor that it substantially alters the distribution of the results in the whole country. For this reason, significant policies aimed at tackling the challenges of the most disadvantaged students should be implemented in order to improve their performance in school but most importantly their future prospects in the labor market and in life. The importance of socioeconomic status is even more visible when taking into account the dependence of the Lebanese educational system on the private sector. Regardless of the subject of study, students from private schools scored significantly higher than their peers from public schools. What is more, the difference between public and private schools on a level similar to Lebanon was observed only in few economies among the participating countries.

The outbreak of the COVID-19 pandemic has influenced how students engage in learning. Before the beginning of the pandemic, the majority of the classes were

conducted in a conventional face-to-face approach. Across the world, students had to get used to the world of remote learning. According to the World Bank, at the beginning of the pandemic in March 2020 in more than 150 countries the authorities decided to suspend on-site learning (Muñoz-Najar et al., 2021). Until the next school year, the restrictions have not been lifted in the majority of the cases. As of the beginning of the school year 2021-2022, many schools have fully opened and have not implemented any restrictions since. In Lebanon, schools were closed for the first time at the beginning of March 2020, and later partially re-opened for short periods in the following school year. As far as the data is available, schools in Lebanon finally fully re-opened in October 2021 and no restrictions have so far limited the learning and teaching on-site. Initially, the estimations calculated by Kuhfeld and Tarasawa (2020) have predicted that students are likely to experience a significant decrease in learning gains in mathematics and reading due to the closure of schools. The evidence has confirmed the estimations, since a significant decrease in students' achievements was noted in the number of case studies in different countries and economies (Engzell, Frey, & Verhagen, 2021; Hevia, & Felipe, 2022; Donnelly, & Patrinos, 2021). Moreover, achievement gaps are even higher among students with a lower socioeconomic status (Pietro et al, 2020). Such a pattern might be resulting from the lack of skills and knowledge among non-educated parents, but also be the outcome of a shortage of digital devices such as computers, tablets and internet accessibility which were crucial during the pandemic to guarantee an effective distance learning.

Table 5.1

Average number of digital resources in Lebanese public and private schools.

Average Number of resources	Public Schools	Private Schools
Computers	22.88 (3.29)	37.37 (4.46)
Computers with internet connection	7.05 (2.75)	31.03 (4.6)
Portable Computers	12.27 (4.12)	9.36 (2.01)
Interactive whiteboards	3.5 (0.84)	14.74 (2.77)
Data projectors	7.26 (0.87)	23.47 (3.34)
Computers with internet connection for teachers	3.82 (0.88)	14.09 (2.53)

Source: Own estimations using PISA 2018 microdata

In the era of distance learning and the pandemic, the influence of socioeconomic status has become more visible than ever before. The most disadvantaged students might not be equipped with the best tools for distance learning, which in consequence might lead to them lagging behind students from more affluent backgrounds. Additionally, the schools from the private sector might have been better equipped when the pandemic started, while schools from the public sector might not only do not have proper tools for conducting distance learning, but also the teachers might have been lacking necessary skills. A substantial gap in the number of computers, computers with an internet connection, interactive whiteboards, data projectors, computers with internet connections accessible to teachers can be seen from the PISA estimates between private and public schools. While the majority of Lebanese students attend a private school, this can still strongly impair the performance of a substantial part of the student population.

In addition, further challenges may arise. The economic crisis generated by the COVID-19 pandemic may negatively impact the socio-economic status of families, which may in turn worsen already challenging situations. It has been demonstrated

that parents with a lower socioeconomic status might be relatively less involved in their children's education, have different strategies concerning their children's development, and not invest as much as parents from more affluent households (Entwisle et al., 1997). PISA estimates show that parental emotional support is strongly correlated with socio-economic status, as is student motivation. A great amount of academic research has been devoted to the issues of how students' motivation impacts their performance (i.e. Meijer, & van den Wittenboer, 2004; Retelsdorf, Köller, & Möller, 2011). Similarly, educational studies have tried to develop more complicated learning approaches which will be more effective in education. Over the years, the data from another large international assessment, TIMSS, has found a positive association between students' performance and factors such as School's emphasis on academic success, school's disciplinary climate, as well as whether students valued and liked learning the examined subjects (Mullis et al., 2020).

In conclusion, the observable influence of socioeconomic status is expected to increase in the following years, since students from more affluent households will possibly have a better access to supportive resources for learning, and in addition might also benefit from a less challenging familiar situation. For this reason, the focus of policies aimed at improving the performance of students should remain on the inequalities in economic and social status, since they can have a very substantial impact on the educational attainments of students and their future prospects in life.

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