



# Policy Brief

## ***Socioeconomically disadvantaged students who are academically successful***

### ***Examining academic resilience cross-nationally***

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## Summary

Academically resilient students are those students who are academically successful, despite coming from the socioeconomically disadvantaged backgrounds that have typically predicted poorer educational outcomes. These students are an important group to study because if policymakers can understand what factors may have contributed to their succeeding against the odds, then they may be better able to support similar students in improving their academic performance. Raising the performance of socioeconomically disadvantaged students benefits both those individual students and the equity of the system overall.

This brief uses 2011 eighth-grade data from the Trends in International Mathematics and Science Study (TIMSS) to explore (1) how prevalent academically resilient students are across education systems and (2) what factors are associated with academic resilience within those systems.

## Policy implications

*Environments of high academic achievement appear to support academic resilience among disadvantaged students.* The proportion of academically resilient students was related both to the proportion of disadvantaged students and overall mean performance in mathematics. That is, there were generally higher percentages of academically resilient students in education systems with lower percentages of disadvantaged students and in education systems that were high performing overall. Education systems that are exceptions to these patterns, such as Hong Kong SAR, Kazakhstan, Turkey, and Thailand, may be worthy of further study.

*Students' high educational aspirations appear to be the strongest and most consistent predictor of academic resilience; other student factors appear to be predictive in multiple education systems, as well.* The other factors were students' valuing of mathematics and experiencing less bullying behaviors. Policies targeting these student factors might be worthy of exploration in supporting disadvantaged students.

*Although not as consistent in predicting academic resilience as the student factors, school factors are also associated with academic resilience.* Three school factors were positively associated with students' academic resilience in multiple education systems: (1) teachers' confidence in students doing well with difficult material in mathematics, as reported by the student; (2) school's emphasis on academic success, as reported by the principal (and indicated by teachers' high expectations for student achievement, effective teachers, students that desire to do well, and parental support); and (3) schools having a lower percentage of economically disadvantaged students, as reported by the principal.



## Policy implications (contd.)

*Policies to increase academic resilience should take into account education system contexts.* The results showed that the factors examined did not have the same associations in all education systems, and all education systems had different sets of factors that were associated with students' academic resilience. Policymakers will need to examine which factors are predictive in their individual systems and what policies or approaches for addressing these factors might be appropriate for their contexts. Moreover, even though the data we used are highly reliable and our study uses sound statistical analyses, policymakers should be aware that these results describe associations rather than causal relationships.

## Introduction

Policymakers across education systems are interested in ensuring a quality education for all students; however, years of research have shown that students from socioeconomically disadvantaged backgrounds have poorer educational outcomes than their more affluent peers (Coleman et al., 1966; Crane, 1996; Sirin, 2005; Sutton & Soderstrom, 1999). These students lack the benefits afforded by the greater educational resources or higher family income, education, and occupational status of some of their peers, and thus may face an uphill battle to achieve. This association between socioeconomic disadvantage and academic performance holds true around the world, in all core subjects (i.e., reading, mathematics, and science), and across grades from primary to upper secondary education (Martin et al., 2012; Mullis et al., 2012; OECD, 2011; Sandoval-Hernandez & Cortes, 2012).

Over the last 20 years, however, there has been an increasing focus on students who succeed educationally against the odds (Borman & Overman, 2004; Finn & Rock, 1997; Martin & Marsh, 2006). Such students are considered “academically resilient,” and related studies typically have focused on identifying and examining the factors that set these students apart from their disadvantaged peers who are less successful, or not resilient. In other words, these studies have asked: “What appears to make

a difference for academically resilient students?” In doing so, they have explored the role that students' attitudes and behaviors—as well as family, school, and/or community factors—may play in fostering academic achievement (Borman & Overman, 2004; OECD, 2011; Sandoval-Hernandez & Cortes, 2012; Waxman & Huang, 1996). The results from these types of studies have the potential to assist policymakers in developing, testing, and implementing interventions targeted to disadvantaged students and supporting them in improving their academic performance.

This brief has two purposes. The first is to explore the prevalence of academic resilience, identifying examples of education systems in which high percentages of disadvantaged students succeed academically. The second is to explore what factors are associated with academic resilience within and across education systems—again, what may make a difference for these students. This analysis can help policymakers understand the factors that may contribute to disadvantaged students—regardless of how prevalent they are in an education system—being able to overcome the obstacles associated with their backgrounds. For each of the diverse education systems in the study, this brief can be suggestive of policy development and provide the basis for further research, particularly at the national level.

## Data

This policy brief uses eighth-grade mathematics data from the 2011 cycle of the IEA's Trends in International Mathematics and Science Study (TIMSS). Administered every four years since 1995, TIMSS is a large-scale, cross-national assessment of fourth- and eighth-grade students' mathematics and science achievement. It also collects extensive background information on the participating students and their schools and teachers.

We use student achievement data as well as data from the student and school questionnaires

both to identify the subgroup of academically resilient students in each education system and to analyze factors that may contribute to academic resilience. Of the 47 education systems whose data are available in the TIMSS 2011 International Database at the eighth grade level, we include the 28 education systems for which there were sufficient numbers of academically resilient students for analysis. These 28 education systems represent a variety of geographical regions and levels of economic development.

## How prevalent are academically resilient students?

Academically resilient students are those who are academically successful despite their disadvantaged circumstances. For this analysis, we define students who are academically successful as those who score at or above the TIMSS 2011 *Intermediate International Benchmark* in mathematics (475). We chose this international measure of success—rather than a nationally-relative one—because it is standardized across education systems and allows us to reference a benchmark that is definable in terms of specific skills and abilities<sup>1</sup>. We also chose an international definition for “disadvantaged students,” whom we define as those classified in the “few resources” category of the *Home Educational Resources* (HER) index, which is a composite measure in the TIMSS 2011 International Database. These students, on average, reported that they had 25 or fewer books in the home, they had neither of two home study supports (their own room nor an internet connection), and neither parent had gone beyond upper-secondary education. Academically resilient students are thus disadvantaged students who are successful in mathematics; they are a subset of disadvantaged students as a whole.<sup>2</sup>

Exhibit 1 shows, for each of the 28 education systems, the percentages of eighth-grade students who fall under our definition of disadvantaged students and, among them, the percentages who are academically resilient. The exhibit also shows the mean mathematics score for all eighth-grade students in each education system. As the exhibit shows, education systems vary widely in the percentages of both disadvantaged students and academically resilient students. The percentage of disadvantaged students ranges from 4 percent in the

Republic of Korea to 62 percent in Ghana, and the percentage of academically resilient students ranges from 4 percent in Ghana to 55 percent in Japan. Generally, education systems with lower percentages of disadvantaged students had larger percentages of academically resilient students and vice versa. There are some exceptions, however. For example, both Hong Kong SAR and Romania have 19 percent of students who are disadvantaged, but in Hong Kong SAR 54 percent of them are academically resilient compared to 16 percent in Romania. At the same time, Turkey has a fairly high percentage of disadvantaged students (54 percent), but a relatively higher percentage of them are academically resilient (27 percent).

Another pattern shown in Exhibit 1 is that the education systems with the largest percentages of academically resilient students tend to be those with higher mean scores overall, although again there are exceptions. Despite not being among the top performing education systems, Kazakhstan has one of the largest percentages of academically resilient students (45 percent) among the disadvantaged students. Turkey and Thailand also have relatively larger percentages of academically resilient students (27 and 20 percent, respectively) despite more than half of the student population being disadvantaged (54 and 52 percent, respectively) and not being among top performing education systems. Thus, while having a larger percentage of disadvantaged students in general appears to be a challenge to the performance of those students and for the education system overall, there are cases where this challenge is overcome. The next section explores those factors that may contribute to academic resilience.

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1 The description of the TIMSS 2011 *Intermediate International Benchmark* in mathematics (475) is provided on page 125 of the TIMSS 2011 Mathematics Report (Mullis et al., 2012).

2 In six education systems (Chinese Taipei, Hong Kong SAR, Japan, the Republic of Korea, the Russian Federation, and Singapore), the mean mathematics score for disadvantaged students was higher than the *Intermediate International Benchmark* (475). In these six cases, we used the mean score for disadvantaged students (instead of the *Intermediate International Benchmark*) to identify the academically resilient students in order to better reflect the concept that resilience implies better-than-average performance.

Exhibit 1. Percentages of disadvantaged students<sup>1</sup> and academically resilient students (ARS)<sup>2</sup>, by education system: TIMSS 2011

Education System	TIMSS 2011 Mathematics Average Score at Grade 8	Percent of Disadvantaged Students	Percent of ARS among Disadvantaged Students	<span style="color: orange;">■</span> Percent of Disadvantaged Students <span style="color: blue;">■</span> Percent of ARS among Disadvantaged Students
Japan	570 (2.6)	5 (0.5)	55 (5.2) †	
Hong Kong SAR	586 (3.8)	19 (0.8)	54 (3.5) †	
Singapore	611 (3.8)	12 (0.6)	52 (3.7) †	
Chinese Taipei	609 (3.2)	12 (0.7)	51 (2.6) †	
Korea, Republic of	613 (2.9)	4 (0.3)	50 (3.9) †	
Russian Federation	539 (3.6)	6 (0.6)	49 (5.4) †	
Kazakhstan	487 (4.0)	15 (1.2)	45 (4.7)	
United States	509 (2.6)	8 (0.4)	42 (2.6)	
Italy	498 (2.4)	12 (0.8)	41 (3.4)	
Lithuania	502 (2.5)	8 (0.6)	29 (3.3)	
Armenia	467 (2.7)	8 (0.5)	27 (4.0)	
Dubai-UAE	478 (2.1)	9 (0.4)	27 (2.8)	
Turkey	452 (3.9)	54 (1.7)	27 (1.4)	
United Arab Emirates	456 (2.1)	12 (0.5)	24 (1.6)	
Lebanon	449 (3.7)	30 (1.6)	21 (1.8)	
Thailand	427 (4.3)	52 (1.5)	20 (1.9)	
Malaysia	440 (5.4)	35 (1.5)	19 (1.9)	
Romania	458 (4.0)	19 (1.2)	16 (2.6)	
Palestinian Nat'l Auth.	404 (3.5)	33 (1.2)	15 (1.4)	
Jordan	406 (3.7)	27 (1.0)	14 (1.3)	
Tunisia	425 (2.8)	38 (1.4)	14 (1.2)	
Saudi Arabia	394 (4.6)	32 (1.6)	13 (1.9)	
Syria, Arab Republic of	380 (4.5)	45 (1.5)	13 (1.5)	
Iran, Islamic Republic of	415 (4.3)	49 (1.8)	12 (1.3)	
Indonesia	386 (4.3)	54 (2.0)	11 (1.1)	
Oman	366 (2.8)	38 (1.0)	8 (0.7)	
Morocco	371 (2.0)	59 (1.1)	6 (0.6)	
Ghana	331 (4.3)	62 (1.8)	4 (0.7)	

Source: International Association for the Evaluation of Educational Achievement (IEA), TIMSS 2011.

Note: Education systems are ordered by the percentage of academically resilient students (ARS). Standard errors appear in parentheses.

1 Disadvantaged students are those in the “few resources” category of the Home Educational Resources (HER) index, which is a composite measure in the TIMSS 2011 International Database. These students reported that they had 25 or fewer books in the home, they had neither of two home study supports (their own room and an internet connection), and neither parent had gone beyond upper-secondary education, on average.

2 Academically resilient students (ARS) are defined as disadvantaged students who performed at or above the TIMSS 2011 Intermediate International Mathematics Benchmark (475). In six education systems, denoted by a single dagger (†), the mean mathematics score for disadvantaged students was higher than this benchmark. In these cases, the mean score for disadvantaged students (instead of the benchmark) was used to identify the ARS.

## What factors are associated with academic resilience?

Based on our review of academic literature and of the TIMSS 2011 questionnaires, we identified eight factors to explore as possible predictors of academic resilience and four factors to use as controls.<sup>3</sup> Exhibit 2 presents these factors.

*Exhibit 2. Variables included in the statistical analyses of academic resilience: TIMSS 2011*

Possible Predictors of Academic Resilience
<i>Student factors</i>
1. Educational aspirations <sup>†</sup>
2. Valuing of mathematics <sup>‡</sup>
3. Experiences with bullying <sup>‡</sup>
<i>School factors</i>
4. Teachers' beliefs that students can do well in mathematics <sup>†</sup>
5. School's percentage of economically disadvantaged students <sup>†</sup>
6. School's emphasis on academic success <sup>†‡</sup>
7. School's safety and discipline <sup>‡</sup>
8. Effects of shortages in educational resources on instruction <sup>†‡</sup>
Controls
a. Student's gender
b. Parents' highest education level <sup>†</sup>
c. How often student speaks language of the test at home <sup>†</sup>
d. Population size of community in which school is located <sup>†</sup>

**Source:** IEA, TIMSS 2011.

<sup>†</sup> Variable was recoded to have two or three categories for the purposes of this study.

<sup>‡</sup> Variable is a composite measure, or index, with three categories. For details about the construction of these indices, see <http://timss.bc.edu/methods/t-context-q-scales.html>.

We conducted logistic regression analyses for each of the 28 education systems, which allowed us to compute odds ratios that describe the odds of disadvantaged students being academically resilient based on each selected factor (controlling for all other variables in the analysis). In our analysis, an odds ratio greater than 1 indicates that a student with that factor (e.g., valuing mathematics) has greater odds of being academically resilient than a student without that factor (e.g., not valuing mathematics); an odds ratio of 1 indicates equal odds and less than 1 indicates lesser odds.<sup>4</sup>

Exhibits 3 and 4 show the odds ratios for each of the student factors and school factors, respectively, for which the association between that factor and being academically resilient was statistically significant in the expected direction in at least two education systems.<sup>5</sup> In these two exhibits, odds ratios for which the relationship of the factor and academic resilience is statistically significant are shaded in dark blue. This brief focuses on those results.

As shown in Exhibit 3, across education systems (and all the factors examined), the strongest and most consistent predictor of academic resilience appeared to be students' educational aspirations. In 20 education systems, the odds of being academically resilient were at least 78 percent higher for disadvantaged students who aspired to obtain a master's degree or Ph.D. than for those who aspired to complete less than college.<sup>6</sup> Students' educational aspirations appeared to be an especially strong predictor in Chinese Taipei and Turkey, where the odds of being academically resilient were over seven or eight times higher for disadvantaged students aspiring to a master's degree or Ph.D. than for those aspiring to complete less than college.

Two other student factors examined also emerged as predictors in multiple education systems. In six education systems, the odds of being academically resilient were at least 56 percent higher for disadvantaged students who reported valuing mathematics (i.e., they agreed with statements about the importance and usefulness of the subject) than for those who reported not valuing mathematics and, at the upper end, the odds were more than three times as high in Malaysia and Saudi Arabia. In six education systems, the odds of being academically resilient were at least 38 percent higher for disadvantaged students who reported almost never being bullied than for those who reported being bullied about weekly; the odds of being academically resilient were more than four times higher in Romania.

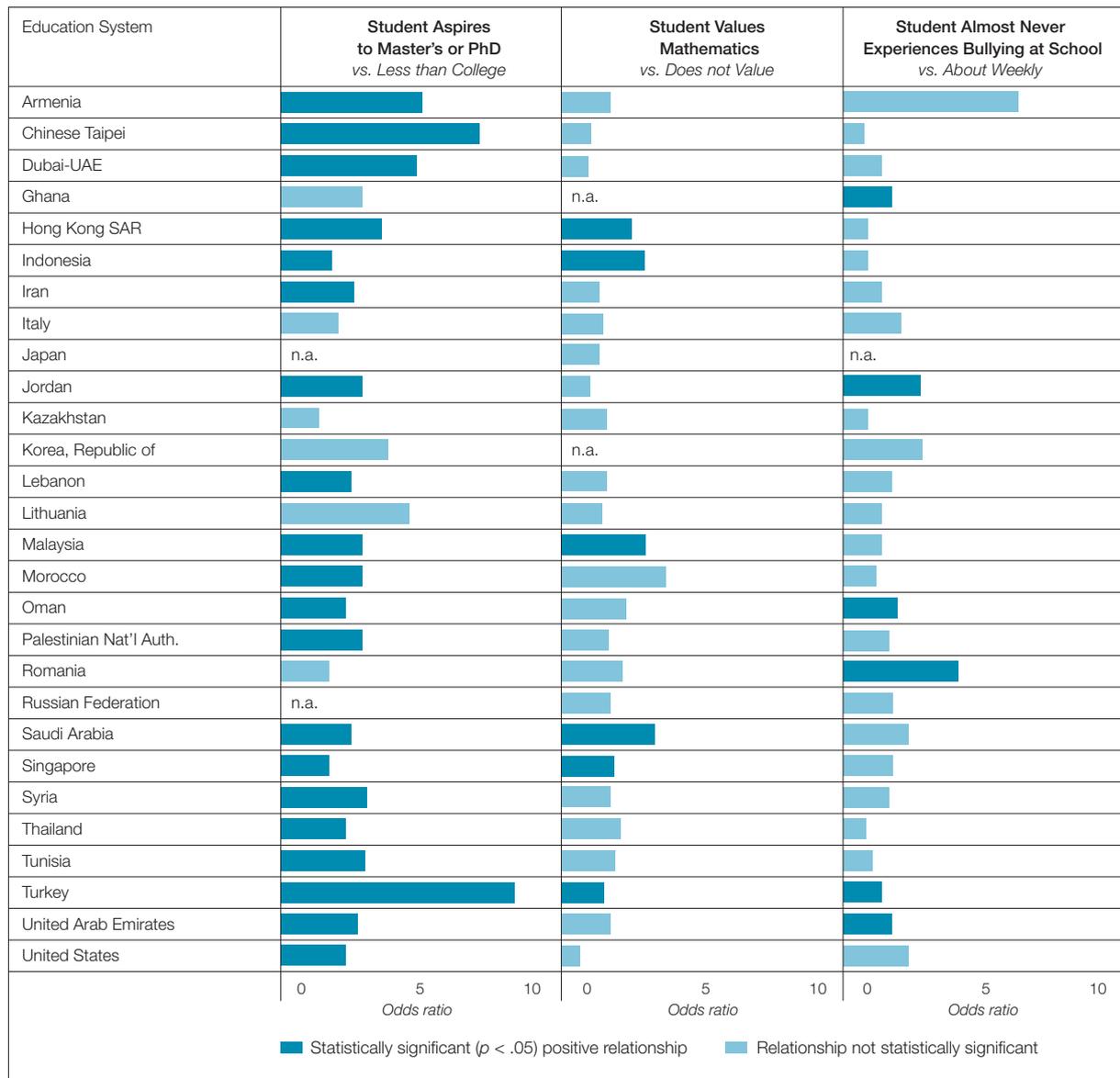
3 We identified these variables using a two-stage process. First, through a review of the literature, we narrowed the list of predictors to consider from about 100 variables in the TIMSS 2011 database to 27. Second, we conducted exploratory analyses with these 27 variables to narrow the list to the 8 predictor variables and 4 control variables used in the statistical analyses. These final 12 variables, from the student and school questionnaires, were those that best fit the set of education systems included in the analyses, rather than being customized for each education system.

4 More specifically, for the interpretation of Exhibits 3 and 4 where we present the results, an odds ratio of between 1 and 2 indicates that the odds are between 0 and 100 percent greater (e.g., an odds ratio of 1.5 would indicate that odds are 50 percent greater). Odds ratios of 2 or more indicate that odds are two or more times greater, respectively.

5 Six of the eight factors listed in Exhibit 2 had statistically significant relationships with academic resilience in the expected direction in at least two education systems. The two factors that did not were "school's safety and discipline" and "effects of shortages in educational resources on instruction"; these are not reported in the text nor shown in Exhibits 3 and 4. We also do not report on the significance of the relationships of the controls and academic resilience.

6 For the factors of educational aspirations, students' valuing of mathematics, experiences with bullying, school's percentage of economically disadvantaged students, and school's discipline and safety, the brief compares students in the extreme categories of these three-category variables (i.e., the "base" and "upper" categories). Comparisons between the base and the middle category were not reported due to space constraints and because the findings were generally redundant with (and somewhat weaker than) those reported.

Exhibit 3. Student factors associated with academic resilience (odds ratios), by education system: TIMSS 2011

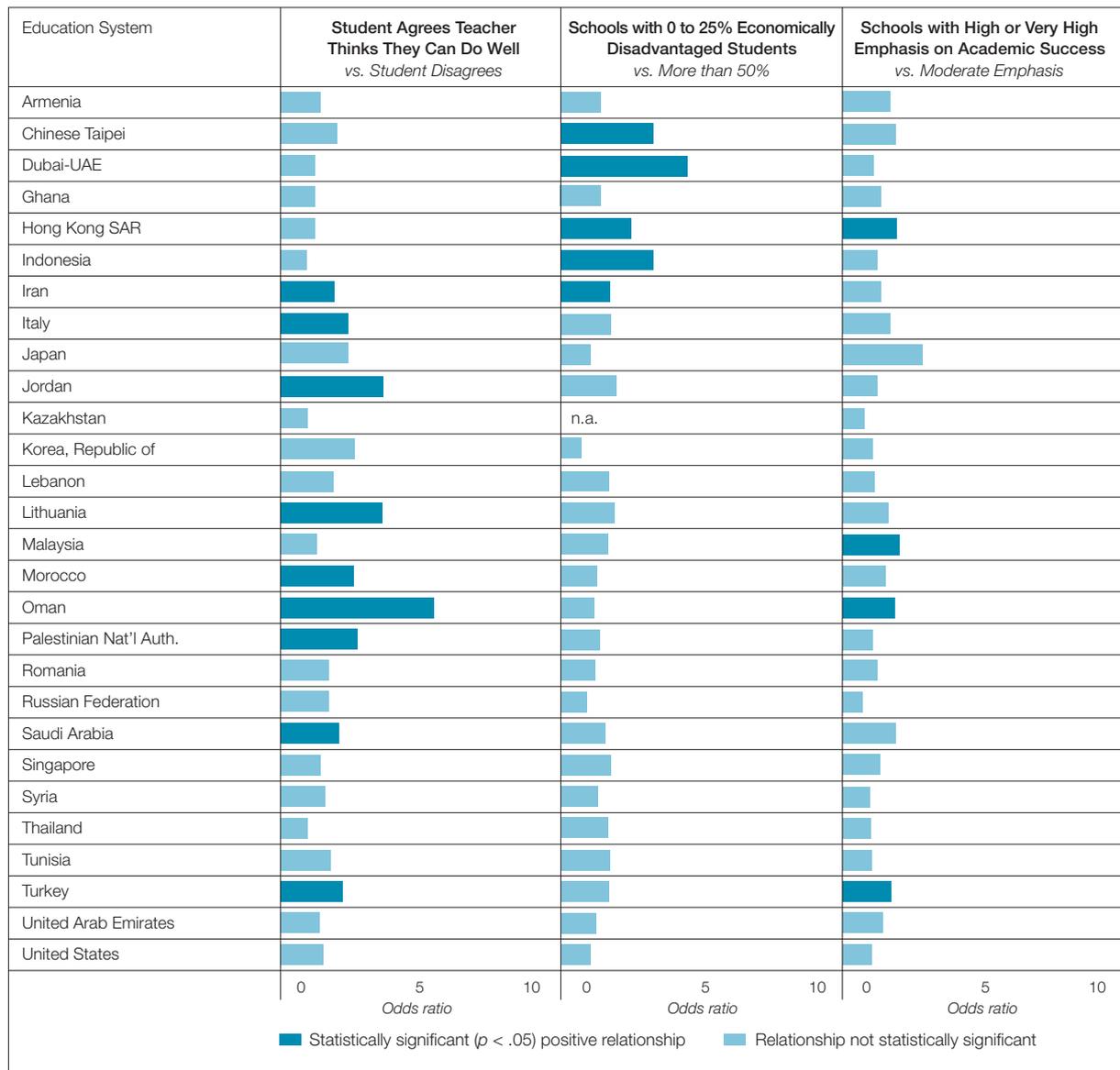


Source: IEA, TIMSS 2011.

Note: Education systems are ordered alphabetically. For the three-category factors, the exhibit shows only the comparisons between students in the extreme categories (i.e., the “base” and “upper” categories, indicated by italics and bold text, respectively). Comparisons between the base and the middle category are not shown due to space constraints and because the findings are generally redundant with (and somewhat weaker than) those shown. Odds ratios that are shaded in dark blue indicate that there is a statistically significant ( $p < .05$ ) positive relationship between the factor and the outcome variable (i.e., being ARS or not).

n.a.: Variable not included in the model because its effects on the outcome variable could not be computed reliably.

Exhibit 4: School factors associated with academic resilience (odds ratios), by education system: TIMSS 2011



**Source:** IEA, TIMSS 2011.

**Note:** Education systems are ordered alphabetically. For the three-category factors, the exhibit shows only the comparisons between students in the extreme categories (i.e., the “base” and “upper” categories, indicated by italics and bold text, respectively). Comparisons between the base and the middle category are not shown due to space constraints and because the findings are generally redundant with (and somewhat weaker than) those shown. Odds ratios that are shaded in dark blue indicate that there is a statistically significant ( $p < .05$ ) positive relationship between the factor and the outcome variable (i.e., being ARS or not).

**n.a.:** Variable not included in the model because its effects on the outcome variable could not be computed reliably.

As shown in Exhibit 4, the school factor that appeared to be the most consistent predictor of academic resilience was students' beliefs about their teachers' confidence in their abilities. In nine education systems, the odds of being academically resilient were at least 75 percent higher for disadvantaged students who agreed that their teacher thought they could do well in mathematics with difficult material than for those who disagreed. Students' beliefs about their teachers' confidence in them appeared to be an especially strong predictor in Oman, where disadvantaged students who agreed that their teacher thought they could do well had over five times the odds of being academically resilient as those who disagreed.

Two of the four other school factors examined also appeared to predict academic resilience in multiple education systems. In five education systems, the odds of being academically resilient were at least 59 percent higher for disadvantaged students

who attended schools with 25 percent or fewer economically disadvantaged students than for those who attended schools with more than 50 percent economically disadvantaged students. This association appeared to be particularly strong in Dubai, where the odds of academic resilience were over four times higher for disadvantaged students in schools with a smaller proportion of economically disadvantaged students compared to those in schools with a higher proportion of economically disadvantaged students. In four education systems, disadvantaged students whose principals thought the school put a high or very high emphasis on academic success (as indicated by teachers' high expectations for student achievement, effective teachers, students that desire to do well, and parental support) had at least 72 percent higher odds of being academically resilient than those whose principals thought there was only a moderate emphasis on academic success.



## Conclusions

1. ***Environments of high academic achievement appear to support academic resilience among disadvantaged students.***

The proportion of academically resilient students was related both to the proportion of disadvantaged students and overall mean performance in mathematics. In general, education systems with lower percentages of disadvantaged students tended to produce larger percentages of academically resilient students among them and vice versa. However, there were exceptions, such as Romania and Hong Kong SAR, which both had 19 percent disadvantaged students, but the former had just 16 percent academically resilient students compared to the latter's 54 percent. The largest proportions of academically resilient students tended also to come from the highest performing education systems. Kazakhstan was an exception, having 45 percent academically resilient students despite not being a top-performing education system. This general finding suggests that disadvantaged students may benefit greatly from environments that support high overall achievement. Exceptions to the general pattern of findings, including Hong Kong SAR, Kazakhstan, Turkey, and Thailand, may be worthy of further study.

2. ***Students' high educational aspirations appear to be the strongest and most consistent predictor of academic resilience; other student factors appeared to be predictive in multiple education systems, as well.***

In 20 education systems, the odds of being academically resilient were at least 78 percent higher for disadvantaged students who aspired to obtain a master's degree or Ph.D. than for those who aspired to complete less than college; at the upper end, the odds were more than 7 or 8 times higher. The other student factors that had positive relationships with academic resilience in multiple education systems were students' valuing of mathematics and experiencing less frequent bullying. Policies could be targeted at helping students recognize the importance and usefulness of mathematics and higher education as well as improving both accessibility to higher education and students' perceptions about the accessibility of it. Recent research on "grit," or individuals' tendency to maintain interest and focused effort on long-term goals, and "growth mindset," or individuals' beliefs that intelligence and success can be developed through effort, may provide insights about related interventions (Blackwell et al., 2007; Duckworth & Gross, 2014; Dweck, 2010; Eskreis-Winkler et al., 2014). Interventions to reduce bullying in schools could be considered as well.

**3. *While not as consistent in predicting academic resilience as the student factors, school factors are also associated with academic resilience in multiple education systems.***

Three of the five school factors we examined—teachers' confidence in students doing well with difficult material in mathematics, as reported by the student; schools' emphasis on academic success as reported by the principal (and indicated by teachers' high expectations for student achievement, effective teachers, students that desire to do well, and parental support), and schools having a lower percentage of economically disadvantaged students, as reported by the principal—were positively associated with students' academic resilience in 9, 4, and 5 education systems, respectively. These results suggest that policymakers could explore interventions aimed at encouraging teachers to maintain positive attitudes about students' learning abilities, supporting principals to increase emphasis on academic success, and developing mechanisms with the potential to help alleviate the economically disadvantaged profile of schools' populations.

**4. *Policies to increase academic resilience should account for education system contexts.***

Our results showed that the factors examined did not have the same associations in all education systems and that all education systems had different sets of factors that were associated with students' academic resilience. While this in part reflects the design of the study—that is, the group of factors selected for analysis and the recoding decisions were those that best fit the set of education systems, rather than being customized for each education system—it does not take away from the broader point that there is not a one-size-fits-all solution. Policymakers in individual education systems will need to examine which factors are relevant in their individual systems and what policies or approaches for addressing these factors might be appropriate for their unique contexts. Moreover, even though the TIMSS data are highly reliable and our study uses sound statistical analyses, it should be noted that TIMSS is an observational study (which describes associations) and not a randomized experiment (which allows causal inferences to be drawn). Nevertheless, the findings are consistent with other findings in the literature reporting associations between disadvantaged students' achievement and factors related to the student and school contexts.





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The International Association for the Evaluation of Educational Achievement, known as IEA, is an independent, international consortium of national research institutions and governmental agencies, with headquarters in Amsterdam. Its primary purpose is to conduct large-scale comparative studies of educational achievement with the aim of gaining more in-depth understanding of the effects of policies and practices within and across systems of education.

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