

WHY DID PISA TEST SCORES RISE IN TURKEY?

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Executive Summary

The Programme for International Student Assessment (PISA) studies the extent to which 15-year-old students have acquired key knowledge and skills in reading, mathematics, science and problem solving. PISA test scores reflect not only what the students have learned but also how well they can apply that knowledge. The results of PISA for Turkey show a significant improvement in average test scores over time. In Mathematics, Turkey's average test score rose from 423 in 2003 to 448 in 2012, the highest increase for any country sampled in this period except Brazil.

Because Turkey has had a period of sustained growth in per-capita income since 2002, the gains in tests scores in the country could simply be a reflection of a pure income effect: with higher family income, students have greater home resources –computers, internet access, encyclopedias, etc.—which allow them to learn more. This study estimates that close to half of the gain in PISA math tests scores between 2003 and 2012 is plainly due to rising family socioeconomic background in the country. However, this also means that the remaining half is connected to other factors that influenced student achievement, including school-related reforms. The most important of these are: improvements in the quantity and quality of schools serving low-income families and those in less-populated areas, improved enrollment and achievement of girls, and rising teacher quality as reflected, for example, in growing teacher expectations in the classroom. At the same time, the study identifies some factors that acted to reduce tests scores between 2003 and 2012: greater student absenteeism (as identified by school principals), which suggests declining student motivation in schools, and rising overage, that is, the presence of older students in any given grade.

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The Determinants of Student Achievement

In order to answer the question of what explains the rising PISA test scores in Turkey, one must first examine what are the factors that determine student achievement and learning. Three major forces can be identified. First, what happens in the family or community has a big influence on learning. The socioeconomic background of a student is linked to home resources such as computers, access to the internet, and greater availability of books, magazines, newspapers, and encyclopedias, among others. Furthermore, the greater the education of parents, the more they can support the learning of their children such as by helping with homework. Second, what happens in schools and in classrooms has a strong impact on student learning. Educational research has shown that the quality of teachers is closely related to student achievement. And, the school's environment --which is fostered by lower class size, the location of the school, and the resources it has available—is also important. For instance, rural schools are usually more difficult to reach geographically and they tend to receive fewer resources than schools in large cities, which shows up in the form of lower student achievement. Third, the characteristics of the student, that is, his or her individual abilities, the student's personal attitudes and motivation, and his or her overall behavior also have a big impact on learning and achievement.

The research in this brief seeks to determine the relative importance of the different factors just mentioned in explaining the rising PISA tests scores in Turkey. The methodology used is to examine first the simple correlation between various determinants of student achievement and the changing tests scores. A multivariate statistical analysis is then performed to specify the role of these explanatory variables in influencing tests scores in 2003 and 2012. A decomposition analysis is then performed, where the role of each variable in determining the rising tests scores is examined. The goal is to determine the most influential factors.

Is Turkey's Rising Socioeconomic Status in the 2000s the Explanation?

Turkey's GDP per capita rose from \$13,217 in 2003 to \$18,167 in 2012, as measured in constant 2011 international dollars. And average educational attainment of the population 25 years of age or older rose by one year between 2000 and 2010, as estimated from the dataset gathered by Robert Barro and Jong-Wha Lee. With families on average more educated and wealthier, could this improvement explain the rising tests scores? Is the simple fact that homes have more resources and parents are more educated what explains the gains in PISA tests results?

One of the background questions in PISA asks students whether they had a computer at home, which they could access for their studies. And, over time, as the average income of Turkish families has increased, so has the ownership of computers. The percentage of students who answered yes to the computer access question rises from 23.2% in 2003 to 66.7% in 2012. But the thing is: students who have access to computers at home also do much better in the PISA tests. As Table 1 shows, in 2012, students with access to a computer at home had an average

math score of 466 while those without it had an average score of 414. So, the rising ownership of home computers, which is itself linked to greater family resources, appears to be connected to higher student achievement.

A second background question asks students whether they had access to an internet link at home that they could use to study. The percentage of students who answered yes to this question rises from 14.4% in 2003 to 56.1% in 2012. And Table 1 shows that students who have access to the internet at home again do much better in the PISA tests. In 2012, students with access to the internet at home had an average math score of 468 while those without it had an average score of 425. Growing family income in Turkey has allowed more families to have internet at home, facilitating the learning of their children.

Table 1 : Home Resources and PISA test scores, 2012

	Students with access to a computer		Students with access to internet link	
	% of total	Mean test score	% of total	Mean test score
Yes	66,7%	466	56,1%	468
No	33,3%	414	41,7%	425

Source: Authors' calculations, PISA-Turkey, 2012.

To measure the overall connection between increased socioeconomic background and test scores, an index of household wealth was constructed by authors based on the PISA questions just discussed (access to computers and internet) as well as others. The index ranges from zero to 10, with a value of 10 indicating that the home has a computer, an internet link, educational software, the student has his or her own room, a desk, a quiet place to study, books to help with school work, including classic literature, a dictionary, and the house has a dishwasher (as a measure of non-educational wealth). A value of zero for the index means the household has none of the above. The average value of this household wealth index rises from 5.43 in 2003 to 7.06 in 2012, or by 30%, which is along the lines of the rise in income per-capita during the same period.

The strong connection between socioeconomic background and PISA test scores is confirmed when a broad index of wealth is considered. Students from families with greater wealth have substantially higher average tests scores. In 2012, students from households with an index of wealth in the range of 0 to 5 had an average math test score equal to 409, while those with an index of 10 had an average tests score of 503.

Similarly, as the educational background of parents increase, the average PISA test scores of their children rises. For students whose parents had not completed primary education, the average PISA math test score was 449 but for parents who had completed a bachelor's degree or equivalent, the average tests score was 562 in 2012.

So, part of the rising achievement observed by PISA in Turkey may indeed be due to the rising socioeconomic background in the country. A later section will show the results of a multivariate statistical analysis of the determinants of changes in math tests scores in Turkey. This research shows that 50% of the rise in PISA tests scores between 2003 and 2012 can be explained by increased socioeconomic background in the country. But this means that 50% is explained by other factors. What are these factors?

The Influence of School-Related Factors: The Quality of Teaching

Educational research almost uniformly recognizes that the quality of teaching is one of the major factors determining student achievement. In the 2000s, Turkey introduced significant reforms in the area of curriculum and teaching that may have contributed to improved student performance.

Curriculum reforms in both primary and secondary education were introduced in the 2000s to make instruction more student-centered and to focus on problem solving skills. And the selection of school teachers underwent a massive overhaul in 2002, when the Ministry of National Education shifted its system of recruiting new teachers from "one based on a lottery to one based on the results of a national examination, the Public Servant Selection Examination (KPSS). In a recent study, M. Alper Dinçer, a researcher with the Education Reform Initiative in Istanbul, studied the effects of the teacher selection reform using data from the 1999 and 2007 Trends in International Mathematics and Science Study (TIMSS). He concludes that the rising average scores displayed by Turkey in that test were partly explained by the teacher recruitment reform, which made teacher assignments respond to a more meritocratic system.

Information provided by PISA for Turkey does not include direct information on teachers. However, principals are administered a questionnaire where they are asked questions about the teachers in their school. One of these questions is about teacher expectations of their students. This is a key issue, as teachers with low expectations tend to adopt sub-standard instructional methods and to accept mediocre work among students, which in effect reduce the quality of teaching. Information from PISA on teacher expectations is utilized here as a proxy for teacher quality.

Table 2 presents data from PISA 2012 and 2003 showing the responses of principals to the question: "Do teachers' low expectations of students in your school hinder the learning of students?" The percentage answering "not at all" more than doubles between 2003 and 2012, rising from 13.1% to 23.7%. Furthermore, those answering "a lot" shrink from 14.7% in 2003 to 2.8% in 2012. As can be seen from Table 2 as well, the test scores of students in schools where teacher expectations are high tend to be much higher than those in low-expectation schools. In 2012, schools where low teacher expectations hindered learning "a lot" had average math tests scores equal to 405, while those students in schools where teacher expectation did not matter "at all" had average tests scores equal to 494.

Why are these results? Why did average teacher quality rise, as seems to be indicated by the data just presented? There are a number of educational initiatives that took place in the 2000s and that may have contributed to the rising student achievement displayed by PISA. The next section documents some of these changes.

Table 2 : "To what Extent is the Learning of Students Hindered by Teachers' Low Expectations of Students in Your School?"

	2003		2012	
	% of total	Average math test score	% of total	Average math test score
Not at all	13,1%	465	23,7%	494
Very little	26,1%	416	43,4%	442
To some extent	46,1%	417	29,1%	425
A lot	14,7%	419	2,8%	405

Source: Authors' calculations, PISA-Turkey, 2003, 2012.

Reducing School Inequities Spurs Average Student Achievement

Rising school investments in rural and small towns and villages greatly expanded educational opportunities in Turkey. The increased access to schooling is reflected in the surging number of secondary schools, which increased from 7,435 in 2005-2006 to 9,672 in 2011-2012, and the growing net enrollment rates in secondary education, which rose from 50.6% in 2002-2003 to 67.4% in 2011-2012.

Aligned with these changes were policies intended to benefit rural schools. As the World Bank study, *Promoting Excellence in Turkey's Schools* –published in 2013-- concludes: “Over 97 percent of schools in Turkey are now connected to the internet, including many of its rural schools...Over 921 million school books have been distributed during 2003-2010 free of charge to all students in primary schools and over 844,000 computers have been allocated to schools as part of the setting up of Information Technology Classrooms in primary and secondary education. ..Turkey introduced incentives...to ensure that teachers are appointed to distant rural schools...For example, new teachers are being asked to work in schools in lagging provinces allowing them to accumulate points which make them eligible later to apply for schools and postings of their choice” (p. 2).

Table 3 shows the growth in PISA math test scores in Turkey, disaggregated by location of the school. For schools located in small towns and villages (with less than 15,000 in population), the increased tests scores was remarkable, rising from an average of 373 in 2003 to 457 in 2012, more than triple the average rise of tests scores in Turkey during this time period. For schools located in towns with population equal to 15,000 or more but below 100,000, the mean growth of math tests scores was from 412 to 458, close to twice the overall, average increase in test scores.

Table 3: Changes in PISA Test Scores 2003-2012, by Location of the School

Location	Average math test score	
	2003	2012
Village/Small town (Less than 15.000)	373	457
Town (15,000 or more but below 100,000)	412	458
City (100,000 or more but below 1 million)	437	432
Large City (1 million or more)	450	449

Source: Authors' calculations, PISA-Turkey, 2003, 2012.

But the climbing student achievement in schools located in small and medium-sized towns was accompanied by a disturbing trend: test scores in cities failed to rise at all between 2003 and 2012 and, in fact, slightly dropped during this time period. It suggests that the rising average PISA test score was not a uniform phenomenon in the country and involved mostly those schools outside large urban areas. The result was that while in 2003 large cities had a 77-point advantage in average PISA test scores, by 2012 the relative standing had been reversed, with students attending schools in villages and small towns having an 8-point advantage.

What caused the stagnating test scores in cities? One factor is connected to the fact that, as Bahçeşehir University researchers Seyfettin Gürsel and Mine Durmaz have documented, the gains in student achievement in Turkey between 2003 and 2012 were greater for those students with families in the lowest part of the income distribution and relatively smaller for those with high-income. But large cities are wealthier and have a greater concentration of high-income populations, so their gains in tests scores would be expected to be lower. At the same time, the difference in student achievement gains between cities and other areas were so dramatic that other forces must be involved as well. The issue should be a matter of concern for policymakers and deserves the serious attention of researchers.

Individual Student Characteristics are Changing in Turkey and they are Affecting Student Achievement

Although what happens in families and in schools deeply affects student achievement, the individual characteristics of students –their gender, age, personality, etc.—all matter as well. Some changes in the individual characteristics displayed by students in secondary schools in Turkey help explain the rising PISA test scores. But some changes have gone in the opposite direction, causing Turkey's PISA test scores to decline.

One positive impact involves gender. The enrollment of girls in schools has risen sharply in recent years. In the 2003-2004 school year, the net enrollment rate in secondary education was 55.7% for males and 45.2% for females. But by 2011-12, the gap had shrunk substantially, with the net enrollment rate for males equal to 68.5% and 66.1% for females.

Although girls show lower average math test scores than boys in PISA, the difference declined between 2003 and 2012. In 2003, the average female math score was 415 and this grew to 444 in 2012. Boys also displayed significant growth in math test scores, with their average increasing from 430 in 2003 to 453 in 2012. But, as can be easily derived from these figures, the increase in test scores for males was 23 points while for females it was 29 points. The more substantial growth of student achievement among girls is displayed not only in math but also in reading. Between 2003 and 2012, the average reading test score of female students grew from 459 to 499 (40 points) while that for males rose from 426 to 453 (27 points). The increase in the relative test scores of girls helps explain the rising average PISA tests scores in Turkey.

But there were some changes in the individual characteristics of students in Turkey that negatively affected achievement. One of them is a rising trend towards skipping classes, truancy and student absenteeism, as perceived by school principals. In response to the question: "To what extent is the learning of students in your school hindered by students skipping classes," 26.4% of school principals said not at all in 2003, but by 2012, the corresponding answer had dropped to 7.1%. In fact, in 2012, over 60% of principals felt that student truancy was hindering learning in their school "to some extent" or "a lot" and over 50% felt that skipping classes was hindering learning "to some extent" or a "lot."

Students in schools where principals feel that student absenteeism, truancy and skipping classes constitute a problem perform significantly worse in PISA than students in schools where this is not an issue. Table 4 shows the average PISA scores of students in Turkey in 2012, depending on the extent to which student truancy is considered to be a problem. As can be seen, for schools where principals felt truancy was not a problem at all, the average PISA math tests score was 535, while students in schools where truancy is considered to hinder learning "a lot" had an average score of 423.

Student absenteeism is an emerging issue in a variety of countries, from India to the United States. Most studies on the issue find a strong negative effect of absenteeism on student achievement, graduation rates, and other student outcomes. In the United States, a 2012 report of the Johns Hopkins University Center for Social Organization of Schools titled *The Importance of Being in School*, finds "an essentially linear relationship where each missed day is associated with a further decline in test scores." What explains the rising absenteeism, truancy and skipping classes in Turkey? Is it an overall decline in the motivation of students to attend school? It is a research topic that should receive careful attention by policymakers in the country.

Table 4: "To What Extent is the Learning of Students Hindered by the Truancy of Students in Your School?"

	Average math test score	% of Total
	2012	2012
Not at all	535	1,9%
Very little	477	34,8%
To some extent	434	37,9%
Very	423	25,4%

Source: Authors' calculations, PISA-Turkey, 2012.

Another factor that appears to have changed significantly between 2003 and 2012 is the grade in which the students surveyed by PISA were enrolled in, which appears to have declined sharply. PISA surveys students who are 15 years old, although students aged two months over 15 are also surveyed. The average age for the students surveyed in Turkey by PISA was almost identical in 2003 and 2012: equal to 15.9 in 2003 and 15.8 in 2012. Yet, the grade level at which students were enrolled dropped significantly over time. In 2003, 93.6% of the students in the PISA study were enrolled in grade tenth or higher, but in 2012, this had declined to 70.3%. In fact, the percentage of students enrolled in ninth grade –versus tenth grade or higher—was 27.2% in 2012 relative to 3.9% in 2003.

Students of the same age who are enrolled at lower grades have of course less time in school and have less knowledge than students who are in higher grades, which impacts negatively on their achievement. In 2012, students in Turkey who were enrolled in the tenth grade had an average test score of 471 while those in the ninth grade had an average of 398. As a result, the lower school grades in which students are enrolled has acted to reduce average tests scores of students in Turkey, as measured by PISA.

One possible explanation for the increased school delay detected by PISA is that a higher proportion of students is being retained in a given grade or has not been promoted to the next grade. This would explain why so many fifteen year olds were in the ninth grade in 2012 while their counterparts would have been in the tenth grade in 2003. Another possibility is that there has been an increase in the age at which children enroll in first grade, which can be the outcome of parental manipulation or because of changes in the school system. In any case, the effects of the increases in the proportion of older students in lower grades on the learning of those students --as well as their peers-- should be a matter for further study. Recent studies using robust statistical methods that adjust for potential selectivity and causality biases tend to indicate that while student grade retention in early grades may raise student achievement, the impact appears to be quite negative for older students, who not only do not appear to display greater academic progress over time, but also suffer from greater dropout rates.

Decomposing the Rising PISA Test Scores

How much was the role of increased income versus school-related and other factors in raising tests scores in Turkey? To answer this question, a multivariate statistical analysis of the determinants of the changes in math tests scores in Turkey between 2003 and 2012 was carried out.

There are two possible sources of change in this context. First, the average value of some of the variables explaining test scores may change over time. For example, it was determined earlier that average socioeconomic background in Turkey rose between 2003 and 2012 and this by itself may have given rise to the increase in test scores. Second, even if the average value of a variable is unchanged over time, if its impact in explaining test scores increases over time, then this might also explain rising test scores. For instance, suppose you consider students with the same socioeconomic background both in 2003 and in 2012, such as students in poor, rural schools. These schools tend to have a shortfall in test scores relative to urban schools. But if rural schools improved their performance between 2003 and 2012 and their shortfall relative to urban schools therefore declined, then this might also explain the rising test scores in Turkey.

In technical terms, the research first estimated educational production functions whose dependent variables were math test scores in 2003 and 2012. The explanatory variables included a set of individual student characteristics, socioeconomic background and school-related inputs. The average change in test scores over time was then decomposed into a component related to changes in the average values of the explanatory variables, and a component related to changes in the impact (or rates of return) of the explanatory variables between 2003 and 2010, based on the well-known decomposition methodology first developed by Ronald Oaxaca, of the University of Arizona, and Alan Blinder, of Princeton University. A summary of the results of this research are presented here, but the detailed statistical analysis is available from the authors.¹

The Oaxaca-Blinder decompositions find that close to half of the gain in PISA test scores in Turkey between 2003 and 2012 is connected to family and socioeconomic factors (parental wealth and education). In other words, the increased income per-capita and educational attainment of families in Turkey allowed them to have greater resources at home and to be able to help their children academically so that their student achievement could rise by almost half of the gain found by PISA. What about the remaining half? The most important factors pushing up average test scores in Turkey include: (1) the rising teacher quality, as reflected in the increased teacher expectations indicator, which was also found to have a stronger impact (a higher rate of return) on student achievement in 2012 than in 2003, and (2) the reductions in educational

¹ Detailed results of Oaxaca-Blinder decomposition analysis can be found in "Explaining the Growth of Student Achievement in Turkey: A Decomposition Analysis of PISA Test Scores" titled BETAM Working Paper (forthcoming)

inequities, spearheaded by the rising relative test scores of children from families with lower socioeconomic background and those located outside large cities.

But there were also factors that acted to reduce average test scores, the most important of which were: (1) the rising student absenteeism, which was also found to have a stronger, negative impact on test scores in 2012 than in 2003, and which may reflect lower student motivation, and (2) the rising proportion of students in lower grades.

Conclusions

The analysis presented in this brief suggests that the increased socioeconomic background of families in the country can explain about half of the rising PISA tests scores in Turkey between 2003 and 2012. This sharply diminishes the role played by other factors in explaining the rising test scores, including the specific education policies adopted by the government.

However, the analysis does suggest that factors other than increased income and wealth do account for half of the rising PISA test scores in Turkey. Among the remaining factors that explain the growth of student achievement in the last decade are some that were linked to policy reforms, including improvements in the quantity and quality of schools serving low-income families and those in less-populated areas, improved enrollment and achievement of girls in schools, and rising teacher quality as reflected, for example, in growing teacher expectations in the classroom.

Finally, the study identifies some factors that acted to reduce tests scores significantly between 2003 and 2012, including greater student absenteeism, truancy and cutting classes (which suggests declining student motivation in schools), and rising overage, that is, the presence of older students in any given grade. There was also a noticeable lack of improvement in the student achievement displayed by schools located in large urban areas. These trends require further research and the serious attention of policymakers as they prevented Turkey from making even stronger gains in student achievement over the last ten years.