Annex A

PISA 2012 TECHNICAL BACKGROUND

All figures and tables in Annex A are available on line

Annex A1: Indices from the student, school and parent context questionnaires
http://dx.doi.org/10.1787/888932937073

Annex A2: The PISA target population, the PISA samples and the definition of schools
http://dx.doi.org/10.1787/888932937092

Annex A3: Technical notes on analyses in this volume

Annex A4: Quality assurance

Annex A5: Technical details of trends analyses
http://dx.doi.org/10.1787/888932937054

Annex A6: Development of the PISA assessment instruments

Annex A7: Technical note on Brazil
http://dx.doi.org/10.1787/888932935743

Notes regarding Cyprus

Note by Turkey: The information in this document with reference to "Cyprus" relates to the southern part of the Island. There is no single authority representing both Turkish and Greek Cypriot people on the Island. Turkey recognises the Turkish Republic of Northern Cyprus (TRNC). Until a lasting and equitable solution is found within the context of the United Nations, Turkey shall preserve its position concerning the "Cyprus issue".

Note by all the European Union Member States of the OECD and the European Union: The Republic of Cyprus is recognised by all members of the United Nations with the exception of Turkey. The information in this document relates to the area under the effective control of the Government of the Republic of Cyprus.

A note regarding Israel

The statistical data for Israel are supplied by and under the responsibility of the relevant Israeli authorities. The use of such data by the OECD is without prejudice to the status of the Golan Heights, East Jerusalem and Israeli settlements in the West Bank under the terms of international law.

ANNEX A1
INDICES FROM THE STUDENT, SCHOOL AND PARENT CONTEXT QUESTIONNAIRES

Explanation of the indices

This section explains the indices derived from the student and school context questionnaires used in PISA 2012.

Several PISA measures reflect indices that summarise responses from students, their parents or school representatives (typically principals) to a series of related questions. The questions were selected from a larger pool of questions on the basis of theoretical considerations and previous research. The *PISA 2012 Assessment and Analytical Framework* (OECD, 2013) provides an in-depth description of this conceptual framework. Structural equation modelling was used to confirm the theoretically expected behaviour of the indices and to validate their comparability across countries. For this purpose, a model was estimated separately for each country and collectively for all OECD countries. For a detailed description of other PISA indices and details on the methods, see the *PISA 2012 Technical Report* (OECD, forthcoming).

There are two types of indices: simple indices and scale indices.

Simple indices are the variables that are constructed through the arithmetic transformation or recoding of one or more items, in exactly the same way across assessments. Here, item responses are used to calculate meaningful variables, such as the recoding of the four-digit ISCO-08 codes into "Highest parents' socio-economic index (HISEI)" or, teacher-student ratio based on information from the school questionnaire.

Scale indices are the variables constructed through the scaling of multiple items. Unless otherwise indicated, the index was scaled using a weighted likelihood estimate (WLE) (Warm, 1989), using a one-parameter item response model (a partial credit model was used in the case of items with more than two categories). For details on how each scale index was constructed see the *PISA 2012 Technical Report* (OECD, forthcoming). In general, the scaling was done in three stages:

- The item parameters were estimated from equal-sized subsamples of students from all participating countries and economies.
- The estimates were computed for all students and all schools by anchoring the item parameters obtained in the preceding step.
- The indices were then standardised so that the mean of the index value for the OECD student population was zero and the standard deviation was one (countries being given equal weight in the standardisation process).

Sequential codes were assigned to the different response categories of the questions in the sequence in which the latter appeared in the student, school or parent questionnaires. Where indicated in this section, these codes were inverted for the purpose of constructing indices or scales. Negative values for an index do not necessarily imply that students responded negatively to the underlying questions. A negative value merely indicates that the respondents answered less positively than all respondents did on average across OECD countries. Likewise, a positive value on an index indicates that the respondents answered more favourably, or more positively, than respondents did, on average, across OECD countries. Terms enclosed in brackets < > in the following descriptions were replaced in the national versions of the student, school and parent questionnaires by the appropriate national equivalent. For example, the term <qualification at ISCED level 5A> was translated in the United States into "Bachelor's degree, post-graduate certificate program, Master's degree program or first professional degree program". Similarly the term <classes in the language of assessment> in Luxembourg was translated into "German classes" or "French classes" depending on whether students received the German or French version of the assessment instruments.

In addition to simple and scaled indices described in this annex, there are a number of variables from the questionnaires that correspond to single items not used to construct indices. These non-recoded variables have prefix of "ST" for the questionnaire items in the student questionnaire, "SC" for the items in the school questionnaire, and "PA" for the items in the parent questionnaire. All the context questionnaires as well as the PISA international database, including all variables, are available through *www.pisa.oecd.org*.

Scaling of questionnaire indices for trend analyses

In PISA, to gather information about students' and schools' characteristics, both students and schools complete a background questionnaire. In PISA 2003 and PISA 2012 several questions were kept untouched, enabling the comparison of responses to these questions over time. In this report, only questions that maintained an exact wording are used for trends analyses. Questions with subtle word changes or questions with major word changes were not compared across time because it is impossible to discern whether observed changes in the response are due to changes in the construct they are measuring or to changes in the way the construct is being measured.

Also, in PISA, as described in Annex A1, questionnaire items are used to construct indices. Whenever the questions used in the construction of indices remains intact in PISA 2003 and PISA 2012, the corresponding indices are compared. Two types of indices are used in PISA: simple indices and scale indices.

Simple indices recode a set of responses to questionnaire items. For trends analyses, the values observed in PISA 2003 are compared directly to PISA 2012, just as simple responses to questionnaire items are. This is the case of indices like student-teacher ratio and ability grouping in mathematics.

Scale indices, on the other hand, imply WLE estimates which require rescaling in order to be comparable across PISA cycles. Scale indices, like the *PISA index of economic, social and cultural status*, the *index of sense of belonging*, the *index of attitudes towards school*, the *index of intrinsic motivation to learn mathematics*, the *index of instrumental motivation to learn mathematics*, the *index of mathematics self-efficacy*, the *index of mathematics self-concept*, the *index of mathematics anxiety*, the *index of teacher shortage*, the *index of quality of physical infrastructure*, the *index of quality of schools' educational resources*, the *index of disciplinary climate*, the *index of teacher-student relations*, the *index of teacher morale*, the *index of student-related factors affecting school climate and* the *index of teacher-related factors affecting school climate*, were scaled, in PISA 2012 to have an OECD average of 0 and a standard deviation of 1, on average, across OECD countries. These same scales were scaled, in PISA 2003, to have an OECD average of 0 and a standard deviation of 1. Because they are on different scales, values reported in *Learning for Tomorrow's World: First Results from PISA 2003* (OECD, 2004) cannot be compared with those reported in this volume. To make these scale indices comparable, values for 2003 have been rescaled to the 2012 scale, using the PISA 2012 parameter estimates.

These re-scaled indices are available at *www.pisa.oecd.org*. They can be merged to the corresponding PISA 2003 dataset using the country names, school and student-level identifiers. The rescaled *PISA index of economic, social and cultural status* is also available to be merged with the PISA 2000, PISA 2006 and PISA 2009 dataset.

Student-level simple indices

Age

The variable AGE is calculated as the difference between the middle month and the year in which students were assessed and their month and year of birth, expressed in years and months.

Study programme

In PISA 2012, study programmes available to 15-year-old students in each country were collected both through the student tracking form and the student questionnaire. All study programmes were classified using ISCED (OECD, 1999). In the PISA international database, all national programmes are indicated in a variable (PROGN) where the first six digits refer to the national centre code and the last two digits to the national study programme code.

The following internationally comparable indices were derived from the data on study programmes:

- Programme level (ISCEDL) indicates whether students are (1) primary education level (ISCED 1); (2) lower-secondary education level (ISCED 2); or (3) upper secondary education level (ISCED 3).
- Programme designation (ISCEDD) indicates the designation of the study programme: (1) = "A" (general programmes designed to give access to the next programme level); (2) = "B" (programmes designed to give access to vocational studies at the next programme level); (3) = "C" (programmes designed to give direct access to the labour market); or (4) = "M" (modular programmes that combine any or all of these characteristics).
- Programme orientation (ISCEDO) indicates whether the programme's curricular content is (1) general; (2) pre-vocational; (3) vocational; or (4) modular programmes that combine any or all of these characteristics.

Occupational status of parents

Occupational data for both a student's father and a student's mother were obtained by asking open-ended questions in the student questionnaire. The responses were coded to four-digit ISCO codes (ILO, 1990) and then mapped to the SEI index of Ganzeboom et al. (1992). Higher scores of SEI indicate higher levels of occupational status. The following three indices are obtained:

- Mother's occupational status (OCOD1).
- Father's occupational status (OCOD2).
- The highest occupational level of parents (HISEI) corresponds to the higher SEI score of either parent or to the only available parent's SEI score.

Education level of parents

The education level of parents is classified using ISCED (OECD, 1999) based on students' responses in the student questionnaire.

As in PISA 2000, 2003, 2006 and 2009, indices were constructed by selecting the highest level for each parent and then assigning them to the following categories: (0) None, (1) ISCED 1 (primary education), (2) ISCED 2 (lower secondary), (3) ISCED 3B or 3C (vocational/pre-vocational upper secondary), (4) ISCED 3A (upper secondary) and/or ISCED 4 (non-tertiary post-secondary), (5) ISCED 5B (vocational tertiary), (6) ISCED 5A, 6 (theoretically oriented tertiary and post-graduate). The following three indices with these categories are developed:

- Mother's education level (MISCED).
- Father's education level (FISCED).
- Highest education level of parents (HISCED) corresponds to the higher ISCED level of either parent.

Highest education level of parents was also converted into the number of years of schooling (PARED). For the conversion of level of education into years of schooling, see Table A1.1.

[Part 1/1]

Table A1.1 Levels of parental education converted into years of schooling

		Completed ISCED level 1 (primary education)	Completed ISCED level 2 (lower secondary education)	Completed ISCED levels 3B or 3C (upper secondary education providing direct access to the labour market or to ISCED 5B programmes)	Completed ISCED level 3A (upper secondary education providing access to ISCED 5A and 5B programmes) and/ or ISCED level 4 (non-tertiary post-secondary)	Completed ISCED level 5A (university level tertiary education) or ISCED level 6 (advanced research programmes)	Completed ISCED level 5B (non-university tertiary education)
OECD	Australia	6.0	10.0	11.0	12.0	15.0	14.0
	Austria	4.0	9.0	12.0	12.5	17.0	15.0
	Belgium[1]	6.0	9.0	12.0	12.0	17.0	15.0
	Canada	6.0	9.0	12.0	12.0	17.0	15.0
	Chile	6.0	8.0	12.0	12.0	17.0	16.0
	Czech Republic	5.0	9.0	11.0	13.0	16.0	16.0
	Denmark	7.0	10.0	13.0	13.0	18.0	16.0
	Estonia	6.0	9.0	12.0	12.0	16.0	15.0
	Finland	6.0	9.0	12.0	12.0	16.5	14.5
	France	5.0	9.0	12.0	12.0	15.0	14.0
	Germany	4.0	10.0	13.0	13.0	18.0	15.0
	Greece	6.0	9.0	11.5	12.0	17.0	15.0
	Hungary	4.0	8.0	10.5	12.0	16.5	13.5
	Iceland	7.0	10.0	13.0	14.0	18.0	16.0
	Ireland	6.0	9.0	12.0	12.0	16.0	14.0
	Israel	6.0	9.0	12.0	12.0	15.0	15.0
	Italy	5.0	8.0	12.0	13.0	17.0	16.0
	Japan	6.0	9.0	12.0	12.0	16.0	14.0
	Korea	6.0	9.0	12.0	12.0	16.0	14.0
	Luxembourg	6.0	9.0	12.0	13.0	17.0	16.0
	Mexico	6.0	9.0	12.0	12.0	16.0	14.0
	Netherlands	6.0	10.0	13.0	12.0	16.0	15.0
	New Zealand	5.5	10.0	11.0	12.0	15.0	14.0
	Norway	6.0	9.0	12.0	12.0	16.0	14.0
	Poland	a	8.0	11.0	12.0	16.0	15.0
	Portugal	6.0	9.0	12.0	12.0	17.0	15.0
	Slovak Republic[2]	4.0	9.0	12.0	13.0	18.0	16.0
	Slovenia	4.0	8.0	11.0	12.0	16.0	15.0
	Spain	5.0	8.0	10.0	12.0	16.5	13.0
	Sweden	6.0	9.0	11.5	12.0	16.0	14.0
	Switzerland	6.0	9.0	12.5	12.5	17.5	14.5
	Turkey	5.0	8.0	11.0	11.0	15.0	13.0
	United Kingdom (exclud. Scotland)	6.0	9.0	12.0	13.0	16.0	15.0
	United Kingdom (Scotland)	7.0	9.0	11.0	13.0	17.0	15.0
	United States	6.0	9.0	a	12.0	16.0	14.0
Partners	Albania	6.0	9.0	12.0	12.0	16.0	16.0
	Argentina	6.0	10.0	12.0	12.0	17.0	14.5
	Azerbaijan	4.0	9.0	11.0	11.0	17.0	14.0
	Brazil	4.0	8.0	11.0	11.0	16.0	14.5
	Bulgaria	4.0	8.0	10.0	12.0	17.5	15.0
	Colombia	5.0	9.0	11.0	11.0	15.5	14.0
	Costa Rica	6.0	9.0	11.0	12.0	14.0	16.0
	Croatia	4.0	8.0	11.0	12.0	17.0	15.0
	Hong Kong-China	6.0	9.0	11.0	13.0	16.0	14.0
	Indonesia	6.0	9.0	12.0	12.0	15.0	14.0
	Jordan	6.0	10.0	12.0	12.0	16.0	14.5
	Kazakhstan	4.0	9.0	11.5	12.5	15.0	14.0
	Latvia	4.0	8.0	11.0	11.0	16.0	14.0
	Liechtenstein	5.0	9.0	11.0	13.0	17.0	14.0
	Lithuania	3.0	8.0	11.0	11.0	16.0	15.0
	Macao-China	6.0	9.0	11.0	12.0	16.0	15.0
	Malaysia	6.0	9.0	11.0	13.0	15.0	16.0
	Montenegro	4.0	8.0	11.0	12.0	16.0	15.0
	Peru	6.0	9.0	11.0	11.0	17.0	14.0
	Qatar	6.0	9.0	12.0	12.0	16.0	15.0
	Romania	4.0	8.0	11.5	12.5	16.0	14.0
	Russian Federation	4.0	9.0	11.5	12.0	15.0	a
	Serbia	4.0	8.0	11.0	12.0	17.0	14.5
	Shanghai-China	6.0	9.0	12.0	12.0	16.0	15.0
	Singapore	6.0	8.0	10.0	11.0	16.0	13.0
	Chinese Taipei	6.0	9.0	12.0	12.0	16.0	14.0
	Thailand	6.0	9.0	12.0	12.0	16.0	14.0
	Tunisia	6.0	9.0	12.0	13.0	17.0	16.0
	United Arab Emirates	5.0	9.0	12.0	12.0	16.0	15.0
	Uruguay	6.0	9.0	12.0	12.0	17.0	15.0
	Viet Nam	5.0	9.0	12.0	12.0	17.0	a

1. In Belgium the distinction between universities and other tertiary schools doesn't match the distinction between ISCED 5A and ISCED 5B.

2. In the Slovak Republic, university education (ISCED 5A) usually lasts five years and doctoral studies (ISCED 6) lasts three more years. Therefore, university graduates will have completed 18 years of study and graduates of doctoral programmes will have completed 21 years of study.

StatLink http://dx.doi.org/10.1787/888932937073

Immigration and language background

Information on the country of birth of students and their parents is collected in a similar manner as in PISA 2000, PISA 2003 and PISA 2006 by using nationally specific ISO coded variables. The ISO codes of the country of birth for students and their parents are available in the PISA international database (COBN_S, COBN_M, and COBN_F).

The index on immigrant background (IMMIG) has the following categories: (1) native students (those students born in the country of assessment, or those with at least one parent born in that country; students who were born abroad with at least one parent born in the country of assessment are also classified as 'native' students), (2) second-generation students (those born in the country of assessment but whose parents were born in another country) and (3) first-generation students (those born outside the country of assessment and whose parents were also born in another country). Students with missing responses for either the student or for both parents, or for all three questions have been given missing values for this variable.

Students indicate the language they usually speak at home. The data are captured in nationally-specific language codes, which were recoded into variable LANGN with the following two values: (1) language at home is the same as the language of assessment, and (2) language at home is a different language than the language of assessment.

Relative grade

Data on the student's grade are obtained both from the student questionnaire and from the student tracking form. As with all variables that are on both the tracking form and the questionnaire, inconsistencies between the two sources are reviewed and resolved during data-cleaning. In order to capture between-country variation, the relative grade index (GRADE) indicates whether students are at the modal grade in a country (value of 0), or whether they are below or above the modal grade level (+ x grades, - x grades).

The relationship between the grade and student performance was estimated through a multilevel model accounting for the following background variables: *i)* the *PISA index of economic, social and cultural status*; *ii)* the *PISA index of economic, social and cultural status* squared; *iii)* the school mean of the *PISA index of economic, social and cultural status; iv)* an indicator as to whether students were foreign-born first-generation students; *v)* the percentage of first-generation students in the school; and *vi)* students' gender.

Table A1.2 presents the results of the multilevel model. Column 1 in Table A1.2 estimates the score-point difference that is associated with one grade level (or school year). This difference can be estimated for the 32 OECD countries in which a sizeable number of 15-year-olds in the PISA samples were enrolled in at least two different grades. Since 15-year-olds cannot be assumed to be distributed at random across the grade levels, adjustments had to be made for the above-mentioned contextual factors that may relate to the assignment of students to the different grade levels. These adjustments are documented in columns 2 to 7 of the table. While it is possible to estimate the typical performance difference among students in two adjacent grades net of the effects of selection and contextual factors, this difference cannot automatically be equated with the progress that students have made over the last school year but should be interpreted as a lower boundary of the progress achieved. This is not only because different students were assessed but also because the content of the PISA assessment was not expressly designed to match what students had learned in the preceding school year but more broadly to assess the cumulative outcome of learning in school up to age 15. For example, if the curriculum of the grades in which 15-year-olds are enrolled mainly includes material other than that assessed by PISA (which, in turn, may have been included in earlier school years) then the observed performance difference will underestimate student progress.

Student-level scale indices

For this cycle, in order to obtain trends for all cycles from 2000 to 2012, the computation of the indices WEALTH, HEDRES, CULTPOSS and HOMEPOS was based on data from all cycles from 2000 to 2012. HOMEPOS is of particular importance as it is used in the computation of ESCS. These were then standardised on 2012 so that the OECD mean is 0 and the standard deviation is 1. This means that the indices calculated on the previous cycle will be on the 2012 scale and thus not directly comparable to the indices in the database for the previously released cycles. To estimate item parameters for scaling, a calibration sample from all cycles was used, consisting of 500 students from all countries in the previous cycles, and 750 from 2012.

The items used in the computation of the indices have changed to some extent from cycle to cycle, thought they have remained much the same from 2006 to 2012. The earlier cycle are in general missing a few items that are present in the later cycles, but it was felt leaving out items only present in the later cycles would give too much weight to the earlier cycles. So a superset of all items (except country specific items) in the five cycles was used, and international item parameters derived from this set.

The second step was to estimate WLEs for the indices, anchoring on the international item set while estimating the country specific items. This is the same procedure used in previous cycles.

A description of the 2012 items used for these indices is given below.

Family wealth

The *index of family wealth* (WEALTH) is based on students' responses on whether they had the following at home: a room of their own, a link to the Internet, a dishwasher (treated as a country-specific item), a DVD player, and three other country-specific items; and their responses on the number of cellular phones, televisions, computers, cars and the number of rooms with a bath or shower.

[Part 1/1]

Table A1.2 A multilevel model to estimate grade effects in mathematics accounting for some background variables

		Multilevel model to estimate grade effects in mathematics performance[1], accounting for:															
		grade		PISA index of economic, social and cultural status		PISA index of economic, social and cultural status squared		school mean of the PISA index of economic, social and cultural status		first-generation students		percentage of first-generation students at the school level		student is a female		intercept	
		Coeff	S.E.	Coeff	S.E.	Coeff	S.E.	Coeff	S.E.	Coeff	S.E.	Coeff	S.E.	Coeff	S.E.	Coeff	S.E.
OECD	Australia	**35**	(2.3)	**20**	(1.4)	1	(1.1)	**68**	(7.1)	6	(3.9)	0	(0.2)	**-12**	(2.9)	481	(4.1)
	Austria	**36**	(2.7)	**11**	(1.8)	-2	(1.6)	**62**	(8.2)	-9	(6.5)	0	(0.3)	**-28**	(3.3)	526	(5.8)
	Belgium	**52**	(2.3)	**9**	(1.4)	**2**	(0.9)	**86**	(9.3)	**-16**	(4.4)	0	(0.4)	**-21**	(2.0)	529	(5.4)
	Canada	**44**	(2.5)	**19**	(1.5)	**3**	(1.1)	**29**	(6.8)	6	(3.7)	0	(0.1)	**-13**	(1.9)	506	(4.0)
	Chile	**33**	(1.8)	**9**	(1.5)	1	(0.7)	**37**	(3.6)	-2	(10.2)	-1	(1.1)	**-29**	(2.1)	469	(4.7)
	Czech Republic	**47**	(3.5)	**13**	(2.0)	-3	(2.0)	**111**	(9.3)	1	(9.1)	-2	(0.9)	**-24**	(2.9)	502	(4.2)
	Denmark	**34**	(3.9)	**26**	(2.2)	2	(1.6)	**44**	(8.0)	**-34**	(5.3)	0	(0.5)	**-18**	(2.2)	483	(5.4)
	Estonia	**41**	(2.7)	**16**	(2.0)	2	(2.3)	**25**	(6.7)	-20	(17.0)	**-4**	(0.6)	**-7**	(2.5)	530	(3.3)
	Finland	**52**	(4.4)	**22**	(2.1)	**6**	(1.9)	**38**	(13.2)	**-38**	(8.7)	-1	(0.8)	1	(3.1)	501	(7.7)
	France	**49**	(4.8)	**16**	(2.3)	2	(1.7)	**60**	(9.5)	-6	(5.8)	0	(0.4)	**-18**	(2.7)	509	(6.3)
	Germany	**41**	(2.1)	**5**	(1.5)	1	(1.4)	**108**	(8.3)	**-20**	(7.9)	**-2**	(0.7)	**-28**	(2.6)	487	(5.6)
	Greece	**41**	(6.3)	**17**	(1.7)	1	(1.2)	**29**	(6.8)	8	(6.3)	0	(0.2)	**-15**	(2.6)	458	(4.5)
	Hungary	**32**	(3.0)	**7**	(1.8)	**3**	(1.2)	**64**	(8.6)	42	(23.9)	**-1**	(0.5)	**-27**	(2.5)	494	(5.6)
	Iceland	c	c	**19**	(3.2)	3	(1.9)	**24**	(9.4)	**-31**	(11.0)	-1	(0.5)	**7**	(3.5)	454	(8.4)
	Ireland	**18**	(1.8)	**24**	(1.7)	1	(1.8)	**60**	(6.1)	**10**	(4.8)	0	(0.3)	**-15**	(3.0)	491	(4.4)
	Israel	**35**	(4.2)	**21**	(2.6)	**3**	(1.5)	**91**	(14.8)	-12	(7.7)	1	(0.8)	**-11**	(4.2)	446	(9.7)
	Italy	**35**	(1.9)	**3**	(0.9)	-1	(0.7)	**54**	(5.5)	**-13**	(3.4)	0	(0.1)	**-23**	(1.7)	495	(3.1)
	Japan	c	c	3	(2.1)	1	(2.2)	**156**	(13.3)	c	c	c	c	**-14**	(3.2)	548	(5.5)
	Korea	**40**	(14.6)	**25**	(4.7)	5	(3.0)	**75**	(20.8)	c	c	c	c	-10	(5.8)	555	(6.2)
	Luxembourg	**50**	(2.3)	**12**	(1.8)	0	(0.8)	**55**	(5.4)	-7	(4.3)	0	(0.1)	**-23**	(2.7)	481	(4.7)
	Mexico	**26**	(1.8)	**8**	(1.1)	**2**	(0.4)	**17**	(2.0)	**-44**	(6.0)	-1	(0.5)	**-14**	(1.5)	451	(3.1)
	Netherlands	**35**	(2.6)	**6**	(1.6)	0	(1.1)	**108**	(22.6)	-14	(9.4)	-1	(1.1)	**-19**	(2.1)	480	(8.1)
	New Zealand	**35**	(5.6)	**31**	(2.5)	-1	(1.8)	**60**	(8.4)	-1	(4.4)	0	(0.4)	**-10**	(3.2)	502	(9.6)
	Norway	**36**	(17.8)	**24**	(2.5)	-2	(1.7)	29	(29.3)	**-21**	(7.8)	-1	(0.8)	3	(4.0)	474	(18.0)
	Poland	**80**	(7.0)	**26**	(2.1)	-2	(1.8)	**37**	(6.9)	c	c	c	c	-5	(3.7)	539	(4.5)
	Portugal	**51**	(2.9)	**17**	(1.5)	2	(0.9)	**27**	(4.0)	10	(7.1)	0	(0.5)	**-17**	(2.2)	540	(4.3)
	Slovak Republic	**42**	(3.8)	**21**	(2.2)	-1	(1.4)	**39**	(7.5)	c	c	c	c	**-20**	(3.0)	530	(4.4)
	Slovenia	**24**	(6.2)	1	(1.7)	**4**	(1.5)	**72**	(12.9)	**-34**	(6.7)	0	(0.8)	**-25**	(2.9)	484	(5.2)
	Spain	**64**	(1.5)	**14**	(0.9)	**2**	(0.7)	**21**	(3.0)	**-16**	(3.0)	0	(0.2)	**-24**	(1.5)	531	(2.4)
	Sweden	**67**	(6.7)	**27**	(2.1)	2	(1.4)	**29**	(7.8)	**-21**	(8.0)	0	(0.2)	3	(3.0)	461	(4.6)
	Switzerland	**52**	(3.0)	**20**	(1.8)	-2	(1.2)	**20**	(7.9)	**-29**	(4.5)	-1	(0.3)	**-20**	(2.4)	528	(4.3)
	Turkey	**29**	(2.9)	1	(2.4)	-1	(1.0)	**47**	(9.1)	c	c	c	c	**-22**	(2.7)	553	(17.0)
	United Kingdom	**23**	(5.4)	**20**	(2.3)	**3**	(1.8)	**88**	(8.2)	4	(6.2)	0	(0.3)	**-9**	(3.2)	465	(4.9)
	United States	**41**	(3.3)	**21**	(1.8)	**7**	(1.5)	**51**	(9.4)	9	(8.0)	**1**	(0.4)	**-12**	(3.5)	457	(6.5)
	OECD average	**41**	(1.0)	**16**	(0.4)	**1**	(0.3)	**56**	(1.9)	**-10**	(1.6)	**0**	(0.1)	**-15**	(0.5)	498	(1.2)
Partners	Albania	6	(3.9)	m	m	m	m	m	m	c	c	c	c	0	(4.1)	395	(4.0)
	Argentina	**31**	(1.7)	**9**	(1.7)	**2**	(0.9)	**38**	(7.1)	1	(12.1)	-2	(1.0)	**-18**	(2.3)	446	(5.3)
	Brazil	**31**	(1.2)	**5**	(2.1)	0	(0.7)	**26**	(4.3)	**-49**	(19.1)	0	(1.4)	**-25**	(1.8)	432	(7.3)
	Bulgaria	**30**	(4.2)	**12**	(1.6)	1	(1.1)	25	(12.6)	c	c	c	c	**-10**	(2.6)	429	(8.0)
	Colombia	**25**	(1.3)	**7**	(2.4)	1	(0.7)	**26**	(4.1)	c	c	c	c	**-30**	(2.0)	444	(5.7)
	Costa Rica	**26**	(1.3)	**8**	(1.6)	1	(0.6)	**25**	(4.2)	-7	(8.0)	0	(0.8)	**-29**	(2.3)	447	(7.5)
	Croatia	**21**	(2.8)	**9**	(1.9)	-1	(1.3)	**71**	(13.7)	-10	(7.6)	-1	(0.9)	**-24**	(2.9)	504	(8.1)
	Cyprus*	**39**	(6.0)	**18**	(1.8)	2	(1.1)	**61**	(8.7)	-5	(5.5)	0	(0.2)	**-14**	(2.4)	439	(5.3)
	Hong Kong-China	**36**	(2.2)	4	(2.6)	1	(1.2)	**48**	(14.5)	**26**	(4.3)	0	(1.0)	**-22**	(3.3)	613	(18.1)
	Indonesia	**17**	(2.7)	**6**	(2.3)	1	(0.6)	**27**	(5.6)	c	c	c	c	**-6**	(1.9)	438	(10.9)
	Jordan	**37**	(5.3)	**12**	(2.1)	**2**	(0.8)	22	(14.9)	6	(6.6)	2	(1.0)	9	(11.7)	393	(11.4)
	Kazakhstan	**16**	(2.5)	**14**	(2.4)	0	(1.5)	**36**	(10.3)	-5	(5.0)	0	(0.3)	-4	(2.2)	459	(5.2)
	Latvia	**53**	(4.0)	**18**	(1.9)	2	(1.8)	**25**	(5.9)	c	c	c	c	**-7**	(3.0)	510	(3.8)
	Liechtenstein	**40**	(8.9)	**8**	(4.1)	-5	(2.7)	**107**	(25.4)	-10	(9.3)	**-2**	(1.0)	**-27**	(5.2)	543	(20.9)
	Lithuania	**32**	(3.4)	**17**	(1.8)	-2	(1.5)	**47**	(6.9)	c	c	c	c	**-7**	(2.6)	483	(4.1)
	Macao-China	**50**	(1.7)	**7**	(2.9)	2	(1.4)	8	(12.2)	**24**	(3.0)	-1	(0.5)	**-26**	(2.3)	544	(14.2)
	Malaysia	**79**	(7.0)	**15**	(2.3)	**2**	(0.9)	**53**	(7.2)	c	c	c	c	2	(2.1)	466	(6.5)
	Montenegro	**9**	(3.1)	**13**	(1.9)	1	(1.0)	**76**	(15.6)	**16**	(7.0)	-2	(1.1)	**-11**	(3.2)	437	(8.6)
	Peru	**25**	(1.3)	**8**	(2.1)	1	(0.6)	**36**	(3.8)	c	c	c	c	**-28**	(2.5)	434	(6.4)
	Qatar	**28**	(2.2)	**6**	(1.4)	1	(0.7)	**26**	(7.9)	**32**	(3.3)	**1**	(0.1)	2	(4.1)	310	(5.4)
	Romania	-5	(5.6)	**20**	(2.3)	**5**	(1.0)	**51**	(9.6)	c	c	c	c	**-7**	(2.8)	475	(7.4)
	Russian Federation	**34**	(2.5)	**22**	(2.2)	-1	(1.5)	**21**	(9.6)	**-16**	(6.4)	**-1**	(0.5)	-2	(2.6)	487	(4.7)
	Serbia	**33**	(10.4)	**8**	(2.1)	-1	(1.7)	**81**	(11.8)	-11	(11.5)	0	(0.9)	**-26**	(3.9)	480	(8.0)
	Shanghai-China	**43**	(5.5)	**6**	(2.4)	**-3**	(1.4)	**52**	(6.5)	-27	(16.1)	-1	(1.0)	**-14**	(2.6)	674	(7.6)
	Singapore	**44**	(3.3)	**21**	(2.2)	0	(1.2)	**81**	(12.6)	**29**	(4.8)	**-1**	(0.3)	-1	(2.7)	608	(9.4)
	Chinese Taipei	**47**	(13.2)	**21**	(3.8)	**-6**	(2.1)	**114**	(9.6)	c	c	c	c	3	(4.1)	638	(9.8)
	Thailand	**16**	(3.9)	**13**	(3.0)	**3**	(1.1)	**-22**	(10.8)	c	c	c	c	2	(3.5)	418	(17.5)
	Tunisia	**36**	(1.7)	**7**	(2.0)	**2**	(0.7)	12	(7.0)	c	c	c	c	**-26**	(1.7)	429	(11.5)
	United Arab Emirates	**33**	(1.5)	**9**	(1.3)	**3**	(0.8)	**23**	(7.4)	**31**	(2.1)	**1**	(0.1)	-2	(4.7)	387	(4.1)
	Uruguay	**39**	(2.1)	**15**	(2.0)	**3**	(0.9)	**35**	(4.3)	c	c	c	c	**-19**	(2.3)	480	(4.7)
	Viet Nam	**36**	(4.8)	**12**	(4.1)	**3**	(1.1)	26	(15.1)	c	c	c	c	**-22**	(4.4)	550	(32.4)

Note: Values that are statistically significant are indicated in bold (see Annex A3).
1. Multilevel regression model (student and school levels): Mathematics performance is regressed on the variables of school policies and practices presented in this table.
* See note at the beginning of this Annex.
StatLink http://dx.doi.org/10.1787/888932937073

Home educational resources

The *index of home educational resources* (HEDRES) is based on the items measuring the existence of educational resources at home including a desk and a quiet place to study, a computer that students can use for schoolwork, educational software, books to help with students' school work, technical reference books and a dictionary.

Cultural possessions

The *index of cultural possessions* (CULTPOSS) is based on the students' responses to whether they had the following at home: classic literature, books of poetry and works of art.

Economic, social and cultural status

The *PISA index of economic, social and cultural status* (ESCS) was derived from the following three indices: *highest occupational status of parents* (HISEI), *highest education level of parents* in years of education according to ISCED (PARED), and *home possessions* (HOMEPOS). The *index of home possessions* (HOMEPOS) comprises all items on the indices of WEALTH, CULTPOSS and HEDRES, as well as books in the home recoded into a four-level categorical variable (0-10 books, 11-25 or 26-100 books, 101-200 or 201-500 books, more than 500 books).

The *PISA index of economic, social and cultural status* (ESCS) was derived from a principal component analysis of standardised variables (each variable has an OECD mean of zero and a standard deviation of one), taking the factor scores for the first principal component as measures of the *PISA index of economic, social and cultural status*.

Principal component analysis was also performed for each participating country to determine to what extent the components of the index operate in similar ways across countries. The analysis revealed that patterns of factor loading were very similar across countries, with all three components contributing to a similar extent to the index (for details on reliability and factor loadings, see the *PISA 2012 Technical Report* (OECD, forthcoming).

The imputation of components for students missing data on one component was done on the basis of a regression on the other two variables, with an additional random error component. The final values on the *PISA index of economic, social and cultural status* (ESCS) for PISA 2012 have an OECD mean of 0 and a standard deviation of one.

ESCS was computed for all students in the five cycles, and ESCS indices for trends analyses were obtained by applying the parameters used to derive standardised values in 2012 to the ESCS components for previous cycles. These values will therefore not be directly comparable to ESCS in the databases for previous cycles, though the differences are not large for the 2006 and 2009 cycles. ESCS in earlier cycles were computed using different algorithms, so for 2000 and 2003 the differences are larger.

Changes to the computation of socio-economic status for PISA 2012

While the computation of socio-economic status followed what had been done in previous cycles, PISA 2012 undertook an important upgrade with respect to the coding of parental occupation. Prior to PISA 2012, the 1988 International Standard Classification of Occupations (ISCO-88) was used for the coding of parental occupation. By 2012, however, ISCO-88 was almost 25 years old and it was no longer tenable to maintain its use as an occupational coding scheme.[1] It was therefore decided to use its replacement, ISCO-08, for occupational coding in PISA 2012.

The change from ISCO-88 to ISCO-08 required an update of the International Socio-Economic Index (ISEI) of occupation codes. PISA 2012 therefore used a modified quantification scheme for ISCO-08 (referred to as ISEI-08), as developed by Harry Ganzeboom (2010). ISEI-08 was constructed using a database of 198 500 men and women with valid education, occupation and (personal) incomes derived from the combined 2002-07 datasets of the International Social Survey Programme (ISSP) (Ganzeboom, 2010). The methodology used for this purpose was similar to the one employed in the construction of ISEI for ISCO-68 and ISCO-88 described in different publications (Ganzeboom et al., 1992; Ganzeboom and Treiman, 1996; Ganzeboom and Treiman, 2003).[2]

The main differences with regard to the previous ISEI construction are the following:

- A new database was used which is more recent, larger and cross-nationally more diverse than the one used earlier.
- The new ISEI was constructed using data for women and men, while previously only men were used to estimate the scale. The data on income were corrected for hours worked to adjust the different prevalence of part-time work between men and women in many countries.

A range of validation activities accompanied the transition from ISCO-88/ISEI-88 to ISCO-08/ISEI-08, including a comparison of (a) the distributions of ISEI-88 with ISEI-08 in terms of range, mean and standard deviations for both mothers' and fathers' occupations and (b) correlations between the two ISEI indicators and performance, again separately undertaken for mothers' and fathers' occupation.

1. The update from ISCO-88 to ISCO-08 mainly involved (a) more adequate categories for IT-related occupations, (b) distinction of military ranks and (c) a revision of the categories classifying different managers.

2. Information on ISCO08 and ISEI08 is included from *http://www.ilo.org/public/english/bureau/stat/isco/index.htm* and *http://home.fsw.vu.nl/hbg.ganzeboom/isco08*

The rotated design of the student questionnaire

A major innovation in PISA 2012 is the rotated design of the student questionnaire. One of the main reasons for a rotated design, which has previously been implemented for the cognitive assessment, was to extend the content coverage of the student questionnaire. Table A1.3 provides an overview of the rotation design and content of questionnaire forms for the main survey.

Table A1.3 Student questionnaire rotation design

Form A	Common Question Set (all forms)	Question Set 1 – Mathematics Attitudes / Problem Solving	Question Set 3 – Opportunity to Learn / Learning Strategies
Form B	Common Question Set (all forms)	Question Set 2 – School Climate / Attitudes towards School / Anxiety	Question Set 1 – Mathematics Attitudes / Problem Solving
Form C	Common Question Set (all forms)	Question Set 3 – Opportunity to Learn / Learning Strategies	Question Set 2 – School Climate / Attitudes towards School / Anxiety

Note: For details regarding the questions in each question set, please refer to *PISA 2012 Technical Report* (OECD, forthcoming).

The *PISA 2012 Technical Report* (OECD, forthcoming) provides all details regarding the rotated design of the student questionnaire in PISA 2012, including its implications in terms of (a) proficiency estimates, (b) international reports and trends, (c) further analyses, (d) structure and documentation of the international database, and (e) logistics have been discussed elsewhere. The rotated design has negligible implications for proficiency estimates and correlations of proficiency estimates with context constructs. The international database (available at *www.pisa.oecd.org*) contains all background variables included for each student whereby ones that s/he has answered reflecting his or her responses and the ones that s/he was not administered showing a distinctive missing code by design. Rotation allows the estimation of a full co-variance matrix which means that all variables can be correlated with all other variables. It does not affect conclusions in terms of whether or not an effect would be considered significant in multilevel models.

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ANNEX A2
THE PISA TARGET POPULATION, THE PISA SAMPLES AND THE DEFINITION OF SCHOOLS

Definition of the PISA target population

PISA 2012 provides an assessment of the cumulative yield of education and learning at a point at which most young adults are still enrolled in initial education.

A major challenge for an international survey is to ensure that international comparability of national target populations is guaranteed in such a venture.

Differences between countries in the nature and extent of pre-primary education and care, the age of entry into formal schooling and the institutional structure of education systems do not allow the definition of internationally comparable grade levels of schooling. Consequently, international comparisons of education performance typically define their populations with reference to a target age group. Some previous international assessments have defined their target population on the basis of the grade level that provides maximum coverage of a particular age cohort. A disadvantage of this approach is that slight variations in the age distribution of students across grade levels often lead to the selection of different target grades in different countries, or between education systems within countries, raising serious questions about the comparability of results across, and at times within, countries. In addition, because not all students of the desired age are usually represented in grade-based samples, there may be a more serious potential bias in the results if the unrepresented students are typically enrolled in the next higher grade in some countries and the next lower grade in others. This would exclude students with potentially higher levels of performance in the former countries and students with potentially lower levels of performance in the latter.

In order to address this problem, PISA uses an age-based definition for its target population, i.e. a definition that is not tied to the institutional structures of national education systems. PISA assesses students who were aged between 15 years and 3 (complete) months and 16 years and 2 (complete) months at the beginning of the assessment period, plus or minus a 1 month allowable variation, and who were enrolled in an educational institution with Grade 7 or higher, regardless of the grade levels or type of institution in which they were enrolled, and regardless of whether they were in full-time or part-time education. Educational institutions are generally referred to as schools in this publication, although some educational institutions (in particular, some types of vocational education establishments) may not be termed schools in certain countries. As expected from this definition, the average age of students across OECD countries was 15 years and 9 months. The range in country means was 2 months and 5 days (0.18 years), from the minimum country mean of 15 years and 8 months to the maximum country mean of 15 years and 10 months.

Given this definition of population, PISA makes statements about the knowledge and skills of a group of individuals who were born within a comparable reference period, but who may have undergone different educational experiences both in and outside of schools. In PISA, these knowledge and skills are referred to as the yield of education at an age that is common across countries. Depending on countries' policies on school entry, selection and promotion, these students may be distributed over a narrower or a wider range of grades across different education systems, tracks or streams. It is important to consider these differences when comparing PISA results across countries, as observed differences between students at age 15 may no longer appear as students' educational experiences converge later on.

If a country's scale scores in reading, scientific or mathematical literacy are significantly higher than those in another country, it cannot automatically be inferred that the schools or particular parts of the education system in the first country are more effective than those in the second. However, one can legitimately conclude that the cumulative impact of learning experiences in the first country, starting in early childhood and up to the age of 15, and embracing experiences both in school, home and beyond, have resulted in higher outcomes in the literacy domains that PISA measures.

The PISA target population did not include residents attending schools in a foreign country. It does, however, include foreign nationals attending schools in the country of assessment.

To accommodate countries that desired grade-based results for the purpose of national analyses, PISA 2012 provided a sampling option to supplement age-based sampling with grade-based sampling.

Population coverage

All countries attempted to maximise the coverage of 15-year-olds enrolled in education in their national samples, including students enrolled in special educational institutions. As a result, PISA 2012 reached standards of population coverage that are unprecedented in international surveys of this kind.

The sampling standards used in PISA permitted countries to exclude up to a total of 5% of the relevant population either by excluding schools or by excluding students within schools. All but eight countries, Luxembourg (8.40%), Canada (6.38%), Denmark (6.18%), Norway (6.11%), Estonia (5.80%), Sweden (5.44%), the United Kingdom (5.43%) and the United States (5.35%), achieved this standard, and in 30 countries and economies, the overall exclusion rate was less than 2%. When language exclusions were accounted for (i.e. removed from the overall exclusion rate), Norway , Sweden, the United Kingdom and the United States no longer had an exclusion rate greater than 5%. For details, see *www.pisa.oecd.org*.

Exclusions within the above limits include:

- At the school level: *i)* schools that were geographically inaccessible or where the administration of the PISA assessment was not considered feasible; and *ii)* schools that provided teaching only for students in the categories defined under "within-school exclusions", such as schools for the blind. The percentage of 15-year-olds enrolled in such schools had to be less than 2.5% of the nationally desired target population [0.5% maximum for *i)* and 2% maximum for *ii)*]. The magnitude, nature and justification of school-level exclusions are documented in the *PISA 2012 Technical Report* (OECD, forthcoming).
- At the student level: *i)* students with an intellectual disability; *ii)* students with a functional disability; *iii)* students with limited assessment language proficiency; *iv)* other – a category defined by the national centres and approved by the international centre; and *v)* students taught in a language of instruction for the main domain for which no materials were available. Students could not be excluded solely because of low proficiency or common discipline problems. The percentage of 15-year-olds excluded within schools had to be less than 2.5% of the nationally desired target population.

Table A2.1 describes the target population of the countries participating in PISA 2012. Further information on the target population and the implementation of PISA sampling standards can be found in the *PISA 2012 Technical Report* (OECD, forthcoming).

- ***Column 1*** shows the *total number of 15-year-olds* according to the most recent available information, which in most countries meant the year 2011 as the year before the assessment.
- ***Column 2*** shows the number of 15-year-olds enrolled in schools in Grade 7 or above (as defined above), which is referred to as the *eligible population*.
- ***Column 3*** shows the *national desired target population*. Countries were allowed to exclude up to 0.5% of students a priori from the eligible population, essentially for practical reasons. The following a priori exclusions exceed this limit but were agreed with the PISA Consortium: Belgium excluded 0.23% of its population for a particular type of student educated while working; Canada excluded 1.14% of its population from Territories and Aboriginal reserves; Chile excluded 0.04% of its students who live in Easter Island, Juan Fernandez Archipelago and Antarctica; Indonesia excluded 1.55% of its students from two provinces because of operational reasons; Ireland excluded 0.05% of its students in three island schools off the west coast; Latvia excluded 0.08% of its students in distance learning schools; and Serbia excluded 2.11% of its students taught in Serbian in Kosovo.
- ***Column 4*** shows the n*umber of students enrolled in schools that were excluded from the national desired target population* either from the sampling frame or later in the field during data collection.
- ***Column 5*** shows the *size of the national desired target population after subtracting the students enrolled in excluded schools*. This is obtained by subtracting Column 4 from Column 3.
- ***Column 6*** shows the *percentage of students enrolled in excluded schools*. This is obtained by dividing Column 4 by Column 3 and multiplying by 100.
- ***Column 7*** shows the *number of students participating in PISA 2012*. Note that in some cases this number does not account for 15-year-olds assessed as part of additional national options.
- ***Column 8*** shows the *weighted number of participating students*, i.e. the number of students in the nationally defined target population that the PISA sample represents.
- Each country attempted to maximise the coverage of the PISA target population within the sampled schools. In the case of each sampled school, all eligible students, namely those 15 years of age, regardless of grade, were first listed. Sampled students who were to be excluded had still to be included in the sampling documentation, and a list drawn up stating the reason for their exclusion. ***Column 9*** indicates the *total number of excluded students*, which is further described and classified into specific categories in Table A2.2.
- ***Column 10*** indicates the *weighted number of excluded students*, i.e. the overall number of students in the nationally defined target population represented by the number of students excluded from the sample, which is also described and classified by exclusion categories in Table A2.2. Excluded students were excluded based on five categories: *i)* students with an intellectual disability – the student has a mental or emotional disability and is cognitively delayed such that he/she cannot perform in the PISA testing situation; *ii)* students with a functional disability – the student has a moderate to severe permanent physical disability such that he/she cannot perform in the PISA testing situation; *iii)* students with a limited assessment language proficiency – the student is unable to read or speak any of the languages of the assessment in the country and would be unable to overcome the language barrier in the testing situation (typically a student who has received less than one year of instruction in the languages of the assessment may be excluded); *iv)* other – a category defined by the national centres and approved by the international centre; and *v)* students taught in a language of instruction for the main domain for which no materials were available.
- ***Column 11*** shows the *percentage of students excluded within schools*. This is calculated as the weighted number of excluded students (Column 10), divided by the weighted number of excluded and participating students (Column 8 plus Column 10), then multiplied by 100.
- ***Column 12*** shows the *overall exclusion rate*, which represents the weighted percentage of the national desired target population excluded from PISA either through school-level exclusions or through the exclusion of students within schools. It is calculated as the school-level exclusion rate (Column 6 divided by 100) plus within-school exclusion rate (Column 11 divided by 100) multiplied by 1 minus the school-level exclusion rate (Column 6 divided by 100). This result is then multiplied by 100. Eight countries, Canada, Denmark, Estonia, Luxembourg, Norway, Sweden, the United Kingdom and the United States, had exclusion rates higher than 5%. When language exclusions were accounted for (i.e. removed from the overall exclusion rate), Norway, Sweden, the United Kingdom and the United States no longer had an exclusion rate greater than 5%".

[Part 1/2]

Table A2.1 PISA target populations and samples

		Population and sample information							
		Total population of 15-year-olds	Total enrolled population of 15-year-olds at Grade 7 or above	Total in national desired target population	Total school-level exclusions	Total in national desired target population after all school exclusions and before within-school exclusions	School-level exclusion rate (%)	Number of participating students	Weighted number of participating students
		(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
OECD	Australia	291 967	288 159	288 159	5 702	282 457	1.98	17 774	250 779
	Austria	93 537	89 073	89 073	106	88 967	0.12	4 756	82 242
	Belgium	123 469	121 493	121 209	1 324	119 885	1.09	9 690	117 912
	Canada	417 873	409 453	404 767	2 936	401 831	0.73	21 548	348 070
	Chile	274 803	252 733	252 625	2 687	249 938	1.06	6 857	229 199
	Czech Republic	96 946	93 214	93 214	1 577	91 637	1.69	6 535	82 101
	Denmark	72 310	70 854	70 854	1 965	68 889	2.77	7 481	65 642
	Estonia	12 649	12 438	12 438	442	11 996	3.55	5 867	11 634
	Finland	62 523	62 195	62 195	523	61 672	0.84	8 829	60 047
	France	792 983	755 447	755 447	27 403	728 044	3.63	5 682	701 399
	Germany	798 136	798 136	798 136	10 914	787 222	1.37	5 001	756 907
	Greece	110 521	105 096	105 096	1 364	103 732	1.30	5 125	96 640
	Hungary	111 761	108 816	108 816	1 725	107 091	1.59	4 810	91 179
	Iceland	4 505	4 491	4 491	10	4 481	0.22	3 508	4 169
	Ireland	59 296	57 979	57 952	0	57 952	0.00	5 016	54 010
	Israel	118 953	113 278	113 278	2 784	110 494	2.46	6 061	107 745
	Italy	605 490	566 973	566 973	8 498	558 475	1.50	38 142	521 288
	Japan	1 241 786	1 214 756	1 214 756	26 099	1 188 657	2.15	6 351	1 128 179
	Korea	687 104	672 101	672 101	3 053	669 048	0.45	5 033	603 632
	Luxembourg	6 187	6 082	6 082	151	5 931	2.48	5 260	5 523
	Mexico	2 114 745	1 472 875	1 472 875	7 307	1 465 568	0.50	33 806	1 326 025
	Netherlands	194 000	193 190	193 190	7 546	185 644	3.91	4 460	196 262
	New Zealand	60 940	59 118	59 118	579	58 539	0.98	5 248	53 414
	Norway	64 917	64 777	64 777	750	64 027	1.16	4 686	59 432
	Poland	425 597	410 700	410 700	6 900	403 800	1.68	5 662	379 275
	Portugal	108 728	127 537	127 537	0	127 537	0.00	5 722	96 034
	Slovak Republic	59 723	59 367	59 367	1 480	57 887	2.49	5 737	54 486
	Slovenia	19 471	18 935	18 935	115	18 820	0.61	7 229	18 303
	Spain	423 444	404 374	404 374	2 031	402 343	0.50	25 335	374 266
	Sweden	102 087	102 027	102 027	1 705	100 322	1.67	4 739	94 988
	Switzerland	87 200	85 239	85 239	2 479	82 760	2.91	11 234	79 679
	Turkey	1 266 638	965 736	965 736	10 387	955 349	1.08	4 848	866 681
	United Kingdom	738 066	745 581	745 581	19 820	725 761	2.66	12 659	688 236
	United States	3 985 714	4 074 457	4 074 457	41 142	4 033 315	1.01	6 111	3 536 153
Partners	Albania	76 910	50 157	50 157	56	50 101	0.11	4 743	42 466
	Argentina	684 879	637 603	637 603	3 995	633 608	0.63	5 908	545 942
	Brazil	3 574 928	2 786 064	2 786 064	34 932	2 751 132	1.25	20 091	2 470 804
	Bulgaria	70 188	59 684	59 684	1 437	58 247	2.41	5 282	54 255
	Colombia	889 729	620 422	620 422	4	620 418	0.00	11 173	560 805
	Costa Rica	81 489	64 326	64 326	0	64 326	0.00	4 602	40 384
	Croatia	48 155	46 550	46 550	417	46 133	0.90	6 153	45 502
	Cyprus*	9 956	9 956	9 955	128	9 827	1.29	5 078	9 650
	Hong Kong-China	84 200	77 864	77 864	813	77 051	1.04	4 670	70 636
	Indonesia	4 174 217	3 599 844	3 544 028	8 039	3 535 989	0.23	5 622	2 645 155
	Jordan	129 492	125 333	125 333	141	125 192	0.11	7 038	111 098
	Kazakhstan	258 716	247 048	247 048	7 374	239 674	2.98	5 808	208 411
	Latvia	18 789	18 389	18 375	655	17 720	3.56	5 276	16 054
	Liechtenstein	417	383	383	1	382	0.26	293	314
	Lithuania	38 524	35 567	35 567	526	35 041	1.48	4 618	33 042
	Macao-China	6 600	5 416	5 416	6	5 410	0.11	5 335	5 366
	Malaysia	544 302	457 999	457 999	225	457 774	0.05	5 197	432 080
	Montenegro	8 600	8 600	8 600	18	8 582	0.21	4 744	7 714
	Peru	584 294	508 969	508 969	263	508 706	0.05	6 035	419 945
	Qatar	11 667	11 532	11 532	202	11 330	1.75	10 966	11 003
	Romania	146 243	146 243	146 243	5 091	141 152	3.48	5 074	140 915
	Russian Federation	1 272 632	1 268 814	1 268 814	17 800	1 251 014	1.40	6 418	1 172 539
	Serbia	80 089	75 870	74 272	1 987	72 285	2.67	4 684	67 934
	Shanghai-China	108 056	90 796	90 796	1 252	89 544	1.38	6 374	85 127
	Singapore	53 637	52 163	52 163	293	51 870	0.56	5 546	51 088
	Chinese Taipei	328 356	328 336	328 336	1 747	326 589	0.53	6 046	292 542
	Thailand	982 080	784 897	784 897	9 123	775 774	1.16	6 606	703 012
	Tunisia	132 313	132 313	132 313	169	132 144	0.13	4 407	120 784
	United Arab Emirates	48 824	48 446	48 446	971	47 475	2.00	11 500	40 612
	Uruguay	54 638	46 442	46 442	14	46 428	0.03	5 315	39 771
	Viet Nam	1 717 996	1 091 462	1 091 462	7 729	1 083 733	0.71	4 959	956 517

Notes: For a full explanation of the details in this table please refer to the *PISA 2012 Technical Report* (OECD, forthcoming). The figure for total national population of 15-year-olds enrolled in Column 2 may occasionally be larger than the total number of 15-year-olds in Column 1 due to differing data sources.
Information for the adjudicated regions is available on line.
* See note at the beginning of this Annex.
StatLink http://dx.doi.org/10.1787/888932937092

[Part 2/2]

Table A2.1 **PISA target populations and samples**

		Population and sample information				Coverage indices		
		Number of excluded students	Weighted number of excluded students	Within-school exclusion rate (%)	Overall exclusion rate (%)	Coverage index 1: Coverage of national desired population	Coverage index 2: Coverage of national enrolled population	Coverage index 3: Coverage of 15-year-old population
		(9)	(10)	(11)	(12)	(13)	(14)	(15)
OECD	Australia	505	5 282	2.06	4.00	0.960	0.960	0.859
	Austria	46	1 011	1.21	1.33	0.987	0.987	0.879
	Belgium	39	367	0.31	1.40	0.986	0.984	0.955
	Canada	1 796	21 013	5.69	6.38	0.936	0.926	0.833
	Chile	18	548	0.24	1.30	0.987	0.987	0.834
	Czech Republic	15	118	0.14	1.83	0.982	0.982	0.847
	Denmark	368	2 381	3.50	6.18	0.938	0.938	0.908
	Estonia	143	277	2.33	5.80	0.942	0.942	0.920
	Finland	225	653	1.08	1.91	0.981	0.981	0.960
	France	52	5 828	0.82	4.42	0.956	0.956	0.885
	Germany	8	1 302	0.17	1.54	0.985	0.985	0.948
	Greece	136	2 304	2.33	3.60	0.964	0.964	0.874
	Hungary	27	928	1.01	2.58	0.974	0.974	0.816
	Iceland	155	156	3.60	3.81	0.962	0.962	0.925
	Ireland	271	2 524	4.47	4.47	0.955	0.955	0.911
	Israel	114	1 884	1.72	4.13	0.959	0.959	0.906
	Italy	741	9 855	1.86	3.33	0.967	0.967	0.861
	Japan	0	0	0.00	2.15	0.979	0.979	0.909
	Korea	17	2 238	0.37	0.82	0.992	0.992	0.879
	Luxembourg	357	357	6.07	8.40	0.872	0.916	0.893
	Mexico	58	3 247	0.24	0.74	0.993	0.993	0.627
	Netherlands	27	1 056	0.54	4.42	0.956	0.956	1.012
	New Zealand	255	2 030	3.66	4.61	0.954	0.954	0.876
	Norway	278	3 133	5.01	6.11	0.939	0.939	0.916
	Poland	212	11 566	2.96	4.59	0.954	0.954	0.891
	Portugal	124	1 560	1.60	1.60	0.984	0.984	0.883
	Slovak Republic	29	246	0.45	2.93	0.971	0.971	0.912
	Slovenia	84	181	0.98	1.58	0.984	0.984	0.940
	Spain	959	14 931	3.84	4.32	0.957	0.957	0.884
	Sweden	201	3 789	3.84	5.44	0.946	0.946	0.930
	Switzerland	256	1 093	1.35	4.22	0.958	0.958	0.914
	Turkey	21	3 684	0.42	1.49	0.985	0.985	0.684
	United Kingdom	486	20 173	2.85	5.43	0.946	0.946	0.932
	United States	319	162 194	4.39	5.35	0.946	0.946	0.887
Partners	Albania	1	10	0.02	0.14	0.999	0.999	0.552
	Argentina	12	641	0.12	0.74	0.993	0.993	0.797
	Brazil	44	4 900	0.20	1.45	0.986	0.986	0.691
	Bulgaria	6	80	0.15	2.55	0.974	0.974	0.773
	Colombia	23	789	0.14	0.14	0.999	0.999	0.630
	Costa Rica	2	12	0.03	0.03	1.000	1.000	0.496
	Croatia	91	627	1.36	2.24	0.978	0.978	0.945
	Cyprus*	157	200	2.03	3.29	0.967	0.967	0.969
	Hong Kong-China	38	518	0.73	1.76	0.982	0.982	0.839
	Indonesia	2	860	0.03	0.26	0.997	0.982	0.634
	Jordan	19	304	0.27	0.39	0.996	0.996	0.858
	Kazakhstan	25	951	0.45	3.43	0.966	0.966	0.806
	Latvia	14	76	0.47	4.02	0.960	0.959	0.854
	Liechtenstein	13	13	3.97	4.22	0.958	0.958	0.753
	Lithuania	130	867	2.56	4.00	0.960	0.960	0.858
	Macao-China	3	3	0.06	0.17	0.998	0.998	0.813
	Malaysia	7	554	0.13	0.18	0.998	0.998	0.794
	Montenegro	4	8	0.10	0.31	0.997	0.997	0.897
	Peru	8	549	0.13	0.18	0.998	0.998	0.719
	Qatar	85	85	0.77	2.51	0.975	0.975	0.943
	Romania	0	0	0.00	3.48	0.965	0.965	0.964
	Russian Federation	69	11 940	1.01	2.40	0.976	0.976	0.921
	Serbia	10	136	0.20	2.87	0.971	0.951	0.848
	Shanghai-China	8	107	0.13	1.50	0.985	0.985	0.788
	Singapore	33	315	0.61	1.17	0.988	0.988	0.952
	Chinese Taipei	44	2 029	0.69	1.22	0.988	0.988	0.891
	Thailand	12	1 144	0.16	1.32	0.987	0.987	0.716
	Tunisia	5	130	0.11	0.24	0.998	0.998	0.913
	United Arab Emirates	11	37	0.09	2.09	0.979	0.979	0.832
	Uruguay	15	99	0.25	0.28	0.997	0.997	0.728
	Viet Nam	1	198	0.02	0.73	0.993	0.993	0.557

Notes: For a full explanation of the details in this table please refer to the *PISA 2012 Technical Report* (OECD, forthcoming). The figure for total national population of 15-year-olds enrolled in Column 2 may occasionally be larger than the total number of 15-year-olds in Column 1 due to differing data sources.
Information for the adjudicated regions is available on line.
* See note at the beginning of this Annex.
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[Part 1/1]

Table A2.2 Exclusions

		Student exclusions (unweighted)						Student exclusions (weighted)					
		Number of excluded students with functional disability (Code 1)	Number of excluded students with intellectual disability (Code 2)	Number of excluded students because of language (Code 3)	Number of excluded students for other reasons (Code 4)	Number of excluded students because of no materials available in the language of instruction (Code 5)	Total number of excluded students	Weighted number of excluded students with functional disability (Code 1)	Weighted number of excluded students with intellectual disability (Code 2)	Weighted number of excluded students because of language (Code 3)	Weighted number of excluded students for other reasons (Code 4)	Weighted number of excluded students because of no materials available in the language of instruction (Code 5)	Total weighted number of excluded students
		(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)	(11)	(12)
OECD	Australia	39	395	71	0	0	505	471	3 925	886	0	0	5 282
	Austria	11	24	11	0	0	46	332	438	241	0	0	1 011
	Belgium	5	22	12	0	0	39	24	154	189	0	0	367
	Canada	82	1 593	121	0	0	1 796	981	18 682	1 350	0	0	21 013
	Chile	3	15	0	0	0	18	74	474	0	0	0	548
	Czech Republic	1	8	6	0	0	15	1	84	34	0	0	118
	Denmark	10	204	112	42	0	368	44	1 469	559	310	0	2 381
	Estonia	7	134	2	0	0	143	14	260	3	0	0	277
	Finland	5	80	101	15	24	225	43	363	166	47	35	653
	France	52	0	0	0	0	52	5 828	0	0	0	0	5 828
	Germany	0	4	4	0	0	8	0	705	597	0	0	1 302
	Greece	3	18	4	111	0	136	49	348	91	1 816	0	2 304
	Hungary	1	15	2	9	0	27	36	568	27	296	0	928
	Iceland	5	105	27	18	0	155	5	105	27	18	0	156
	Ireland	13	159	33	66	0	271	121	1 521	283	599	0	2 524
	Israel	9	91	14	0	0	114	133	1 492	260	0	0	1 884
	Italy	64	566	111	0	0	741	596	7 899	1 361	0	0	9 855
	Japan	0	0	0	0	0	0	0	0	0	0	0	0
	Luxembourg	6	261	90	0	0	357	6	261	90	0	0	357
	Mexico	21	36	1	0	0	58	812	2 390	45	0	0	3 247
	Netherlands	5	21	1	0	0	27	188	819	50	0	0	1 056
	New Zealand	27	118	99	0	11	255	235	926	813	0	57	2 030
	Norway	11	192	75	0	0	278	120	2 180	832	0	0	3 133
	Poland	23	89	6	88	6	212	1 470	5 187	177	4 644	89	11 566
	Portugal	69	48	7	0	0	124	860	605	94	0	0	1 560
	Korea	2	15	0	0	0	17	223	2 015	0	0	0	2 238
	Slovak Republic	2	14	0	13	0	29	22	135	0	89	0	246
	Slovenia	13	27	44	0	0	84	23	76	81	0	0	181
	Spain	56	679	224	0	0	959	618	11 330	2 984	0	0	14 931
	Sweden	120	0	81	0	0	201	2 218	0	1 571	0	0	3 789
	Switzerland	7	99	150	0	0	256	41	346	706	0	0	1 093
	Turkey	5	14	2	0	0	21	757	2 556	371	0	0	3 684
	United Kingdom	40	405	41	0	0	486	1 468	15 514	3 191	0	0	20 173
	United States	37	219	63	0	0	319	18 399	113 965	29 830	0	0	162 194
Partners	Albania	0	0	1	0	0	1	0	0	10	0	0	10
	Argentina	1	11	0	0	0	12	84	557	0	0	0	641
	Brazil	17	27	0	0	0	44	1 792	3 108	0	0	0	4 900
	Bulgaria	6	0	0	0	0	6	80	0	0	0	0	80
	Colombia	12	10	1	0	0	23	397	378	14	0	0	789
	Costa Rica	0	2	0	0	0	2	0	12	0	0	0	12
	Croatia	10	78	3	0	0	91	69	539	19	0	0	627
	Cyprus*	8	54	60	35	0	157	9	64	72	55	0	200
	Hong Kong-China	4	33	1	0	0	38	57	446	15	0	0	518
	Indonesia	1	0	1	0	0	2	426	0	434	0	0	860
	Jordan	8	6	5	0	0	19	109	72	122	0	0	304
	Kazakhstan	9	16	0	0	0	25	317	634	0	0	0	951
	Latvia	3	7	4	0	0	14	8	45	24	0	0	76
	Liechtenstein	1	7	5	0	0	13	1	7	5	0	0	13
	Lithuania	10	120	0	0	0	130	66	801	0	0	0	867
	Macao-China	0	1	2	0	0	3	0	1	2	0	0	3
	Malaysia	3	4	0	0	0	7	274	279	0	0	0	554
	Montenegro	3	1	0	0	0	4	7	1	0	0	0	8
	Peru	3	5	0	0	0	8	269	280	0	0	0	549
	Qatar	23	43	19	0	0	85	23	43	19	0	0	85
	Romania	0	0	0	0	0	0	0	0	0	0	0	0
	Russian Federation	25	40	4	0	0	69	4 345	6 934	660	0	0	11 940
	Serbia	4	4	2	0	0	10	53	55	28	0	0	136
	Shanghai-China	1	6	1	0	0	8	14	80	14	0	0	107
	Singapore	5	17	11	0	0	33	50	157	109	0	0	315
	Chinese Taipei	6	36	2	0	0	44	296	1 664	70	0	0	2 029
	Thailand	2	10	0	0	0	12	13	1 131	0	0	0	1 144
	Tunisia	4	1	0	0	0	5	104	26	0	0	0	130
	United Arab Emirates	3	7	1	0	0	11	26	9	2	0	0	37
	Uruguay	9	6	0	0	0	15	66	33	0	0	0	99
	Viet Nam	0	1	0	0	0	1	0	198	0	0	0	198

Exclusion codes:
Code 1 Functional disability – student has a moderate to severe permanent physical disability.
Code 2 Intellectual disability – student has a mental or emotional disability and has either been tested as cognitively delayed or is considered in the professional opinion of qualified staff to be cognitively delayed.
Code 3 Limited assessment language proficiency – student is not a native speaker of any of the languages of the assessment in the country and has been resident in the country for less than one year.
Code 4 Other reasons defined by the national centres and approved by the international centre.
Code 5 No materials available in the language of instruction.
Note: For a full explanation of the details in this table please refer to the *PISA 2012 Technical Report* (OECD, forthcoming).
Information for the adjudicated regions is available on line.
* See note at the beginning of this Annex.
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- ***Column 13*** presents an *index of the extent to which the national desired target population is covered by the PISA sample*. Canada, Denmark, Estonia, Luxembourg, Norway, Sweden, the United Kingdom and the United States were the only countries where the coverage is below 95%.
- ***Column 14*** presents an *index of the extent to which 15-year-olds enrolled in schools are covered by the PISA sample*. The index measures the overall proportion of the national enrolled population that is covered by the non-excluded portion of the student sample. The index takes into account both school-level and student-level exclusions. Values close to 100 indicate that the PISA sample represents the entire education system as defined for PISA 2012. The index is the weighted number of participating students (Column 8) divided by the weighted number of participating and excluded students (Column 8 plus Column 10), times the nationally defined target population (Column 5) divided by the eligible population (Column 2).
- ***Column 15*** presents an *index of the coverage of the 15-year-old population*. This index is the weighted number of participating students (Column 8) divided by the total population of 15-year-old students (Column 1).

This high level of coverage contributes to the comparability of the assessment results. For example, even assuming that the excluded students would have systematically scored worse than those who participated, and that this relationship is moderately strong, an exclusion rate in the order of 5% would likely lead to an overestimation of national mean scores of less than 5 score points (on a scale with an international mean of 500 score points and a standard deviation of 100 score points). This assessment is based on the following calculations: if the correlation between the propensity of exclusions and student performance is 0.3, resulting mean scores would likely be overestimated by 1 score point if the exclusion rate is 1%, by 3 score points if the exclusion rate is 5%, and by 6 score points if the exclusion rate is 10%. If the correlation between the propensity of exclusions and student performance is 0.5, resulting mean scores would be overestimated by 1 score point if the exclusion rate is 1%, by 5 score points if the exclusion rate is 5%, and by 10 score points if the exclusion rate is 10%. For this calculation, a model was employed that assumes a bivariate normal distribution for performance and the propensity to participate. For details, see the *PISA 2012 Technical Report* (OECD, forthcoming).

Sampling procedures and response rates

The accuracy of any survey results depends on the quality of the information on which national samples are based as well as on the sampling procedures. Quality standards, procedures, instruments and verification mechanisms were developed for PISA that ensured that national samples yielded comparable data and that the results could be compared with confidence.

Most PISA samples were designed as two-stage stratified samples (where countries applied different sampling designs, these are documented in the *PISA 2012 Technical Report* [OECD, forthcoming]). The first stage consisted of sampling individual schools in which 15-year-old students could be enrolled. Schools were sampled systematically with probabilities proportional to size, the measure of size being a function of the estimated number of eligible (15-year-old) students enrolled. A minimum of 150 schools were selected in each country (where this number existed), although the requirements for national analyses often required a somewhat larger sample. As the schools were sampled, replacement schools were simultaneously identified, in case a sampled school chose not to participate in PISA 2012.

In the case of Iceland, Liechtenstein, Luxembourg, Macao-China and Qatar, all schools and all eligible students within schools were included in the sample.

Experts from the PISA Consortium performed the sample selection process for most participating countries and monitored it closely in those countries that selected their own samples. The second stage of the selection process sampled students within sampled schools. Once schools were selected, a list of each sampled school's 15-year-old students was prepared. From this list, 35 students were then selected with equal probability (all 15-year-old students were selected if fewer than 35 were enrolled). The number of students to be sampled per school could deviate from 35, but could not be less than 20.

Data-quality standards in PISA required minimum participation rates for schools as well as for students. These standards were established to minimise the potential for response biases. In the case of countries meeting these standards, it was likely that any bias resulting from non-response would be negligible, i.e. typically smaller than the sampling error.

A minimum response rate of 85% was required for the schools initially selected. Where the initial response rate of schools was between 65% and 85%, however, an acceptable school response rate could still be achieved through the use of replacement schools. This procedure brought with it a risk of increased response bias. Participating countries were, therefore, encouraged to persuade as many of the schools in the original sample as possible to participate. Schools with a student participation rate between 25% and 50% were not regarded as participating schools, but data from these schools were included in the database and contributed to the various estimations. Data from schools with a student participation rate of less than 25% were excluded from the database.

PISA 2012 also required a minimum participation rate of 80% of students within participating schools. This minimum participation rate had to be met at the national level, not necessarily by each participating school. Follow-up sessions were required in schools in which too few students had participated in the original assessment sessions. Student participation rates were calculated over all original schools, and also over all schools, whether original sample or replacement schools, and from the participation of students in both the original assessment and any follow-up sessions. A student who participated in the original or follow-up cognitive sessions was regarded as a participant. Those who attended only the questionnaire session were included in the international database and contributed to the statistics presented in this publication if they provided at least a description of their father's or mother's occupation.

[Part 1/2]

Table A2.3 **Response rates**

		Initial sample – before school replacement					Final sample – after school replacement		
		Weighted school participation rate before replacement (%)	Weighted number of responding schools (weighted also by enrolment)	Weighted number of schools sampled (responding and non-responding) (weighted also by enrolment)	Number of responding schools (unweighted)	Number of responding and non-responding schools (unweighted)	Weighted school participation rate after replacement (%)	Weighted number of responding schools (weighted also by enrolment)	Weighted number of schools sampled (responding and non-responding) (weighted also by enrolment)
		(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
OECD	Australia	98	268 631	274 432	757	790	98	268 631	274 432
	Austria	100	88 967	88 967	191	191	100	88 967	88 967
	Belgium	84	100 482	119 019	246	294	97	115 004	119 006
	Canada	91	362 178	396 757	828	907	93	368 600	396 757
	Chile	92	220 009	239 429	200	224	99	236 576	239 370
	Czech Republic	98	87 238	88 884	292	297	100	88 447	88 797
	Denmark	87	61 749	71 015	311	366	96	67 709	70 892
	Estonia	100	12 046	12 046	206	206	100	12 046	12 046
	Finland	99	59 740	60 323	310	313	99	59 912	60 323
	France	97	703 458	728 401	223	231	97	703 458	728 401
	Germany	98	735 944	753 179	227	233	98	737 778	753 179
	Greece	93	95 107	102 087	176	192	99	100 892	102 053
	Hungary	98	99 317	101 751	198	208	99	101 187	101 751
	Iceland	99	4 395	4 424	133	140	99	4 395	4 424
	Ireland	99	56 962	57 711	182	185	99	57 316	57 711
	Israel	91	99 543	109 326	166	186	94	103 075	109 895
	Italy	89	478 317	536 921	1 104	1 232	97	522 686	536 821
	Japan	86	1 015 198	1 175 794	173	200	96	1 123 211	1 175 794
	Korea	100	661 575	662 510	156	157	100	661 575	662 510
	Luxembourg	100	5 931	5 931	42	42	100	5 931	5 931
	Mexico	92	1 323 816	1 442 242	1 431	1 562	95	1 374 615	1 442 234
	Netherlands	75	139 709	185 468	148	199	89	165 635	185 320
	New Zealand	81	47 441	58 676	156	197	89	52 360	58 616
	Norway	85	54 201	63 653	177	208	95	60 270	63 642
	Poland	85	343 344	402 116	159	188	98	393 872	402 116
	Portugal	95	122 238	128 129	186	195	96	122 713	128 050
	Slovak Republic	87	50 182	57 353	202	236	99	57 599	58 201
	Slovenia	98	18 329	18 680	335	353	98	18 329	18 680
	Spain	100	402 604	403 999	902	904	100	402 604	403 999
	Sweden	99	98 645	99 726	207	211	100	99 536	99 767
	Switzerland	94	78 825	83 450	397	422	98	82 032	83 424
	Turkey	97	921 643	945 357	165	170	100	944 807	945 357
	United Kingdom	80	564 438	705 011	477	550	89	624 499	699 839
	United States	67	2 647 253	3 945 575	139	207	77	3 040 661	3 938 077
Partners	Albania	100	49 632	49 632	204	204	100	49 632	49 632
	Argentina	95	578 723	606 069	218	229	96	580 989	606 069
	Brazil	93	2 545 863	2 745 045	803	886	95	2 622 293	2 747 688
	Bulgaria	99	57 101	57 574	186	188	100	57 464	57 574
	Colombia	87	530 553	612 605	323	363	97	596 557	612 261
	Costa Rica	99	64 235	64 920	191	193	99	64 235	64 920
	Croatia	99	45 037	45 636	161	164	100	45 608	45 636
	Cyprus*	97	9 485	9 821	117	131	97	9 485	9 821
	Hong Kong-China	79	60 277	76 589	123	156	94	72 064	76 567
	Indonesia	95	2 799 943	2 950 696	199	210	98	2 892 365	2 951 028
	Jordan	100	119 147	119 147	233	233	100	119 147	119 147
	Kazakhstan	100	239 767	239 767	218	218	100	239 767	239 767
	Latvia	88	15 371	17 488	186	213	100	17 428	17 448
	Liechtenstein	100	382	382	12	12	100	382	382
	Lithuania	98	33 989	34 614	211	216	100	34 604	34 604
	Macao-China	100	5 410	5 410	45	45	100	5 410	5 410
	Malaysia	100	455 543	455 543	164	164	100	455 543	455 543
	Montenegro	100	8 540	8 540	51	51	100	8 540	8 540
	Peru	98	503 915	514 574	238	243	99	507 602	514 574
	Qatar	100	11 333	11 340	157	164	100	11 333	11 340
	Romania	100	139 597	139 597	178	178	100	139 597	139 597
	Russian Federation	100	1 243 564	1 243 564	227	227	100	1 243 564	1 243 564
	Serbia	90	65 537	72 819	143	160	95	69 433	72 752
	Shanghai-China	100	89 832	89 832	155	155	100	89 832	89 832
	Singapore	98	50 415	51 687	170	176	98	50 945	51 896
	Chinese Taipei	100	324 667	324 667	163	163	100	324 667	324 667
	Thailand	98	757 516	772 654	235	240	100	772 452	772 654
	Tunisia	99	129 229	130 141	152	153	99	129 229	130 141
	United Arab Emirates	99	46 469	46 748	453	460	99	46 469	46 748
	Uruguay	99	45 736	46 009	179	180	100	46 009	46 009
	Viet Nam	100	1 068 462	1 068 462	162	162	100	1 068 462	1 068 462

Information for the adjudicated regions is available on line.
* See note at the beginning of this Annex.
StatLink http://dx.doi.org/10.1787/888932937092

[Part 2/2]

Table A2.3 Response rates

		Final sample – after school replacement		Final sample – students within schools after school replacement				
		Number of responding schools (unweighted)	Number of responding and non-responding schools (unweighted)	Weighted student participation rate after replacement (%)	Number of students assessed (weighted)	Number of students sampled (assessed and absent) (weighted)	Number of students assessed (unweighted)	Number of students sampled (assessed and absent) (unweighted)
		(9)	(10)	(11)	(12)	(13)	(14)	(15)
OECD	Australia	757	790	87	213 495	246 012	17 491	20 799
	Austria	191	191	92	75 393	82 242	4 756	5 318
	Belgium	282	294	91	103 914	114 360	9 649	10 595
	Canada	840	907	81	261 928	324 328	20 994	25 835
	Chile	221	224	95	214 558	226 689	6 857	7 246
	Czech Republic	295	297	90	73 536	81 642	6 528	7 222
	Denmark	339	366	89	56 096	62 988	7 463	8 496
	Estonia	206	206	93	10 807	11 634	5 867	6 316
	Finland	311	313	91	54 126	59 653	8 829	9 789
	France	223	231	89	605 371	676 730	5 641	6 308
	Germany	228	233	93	692 226	742 416	4 990	5 355
	Greece	188	192	97	92 444	95 580	5 125	5 301
	Hungary	204	208	93	84 032	90 652	4 810	5 184
	Iceland	133	140	85	3 503	4 135	3 503	4 135
	Ireland	183	185	84	45 115	53 644	5 016	5 977
	Israel	172	186	90	91 181	101 288	6 061	6 727
	Italy	1 186	1 232	93	473 104	510 005	38 084	41 003
	Japan	191	200	96	1 034 803	1 076 786	6 351	6 609
	Korea	156	157	99	595 461	603 004	5 033	5 101
	Luxembourg	42	42	95	5 260	5 523	5 260	5 523
	Mexico	1 468	1 562	94	1 193 866	1 271 639	33 786	35 972
	Netherlands	177	199	85	148 432	174 697	4 434	5 215
	New Zealand	177	197	85	40 397	47 703	5 248	6 206
	Norway	197	208	91	51 155	56 286	4 686	5 156
	Poland	182	188	88	325 389	371 434	5 629	6 452
	Portugal	187	195	87	80 719	92 395	5 608	6 426
	Slovak Republic	231	236	94	50 544	53 912	5 737	6 106
	Slovenia	335	353	90	16 146	17 849	7 211	7 921
	Spain	902	904	90	334 382	372 042	26 443	29 027
	Sweden	209	211	92	87 359	94 784	4 739	5 141
	Switzerland	410	422	92	72 116	78 424	11 218	12 138
	Turkey	169	170	98	850 830	866 269	4 847	4 939
	United Kingdom	505	550	86	528 231	613 736	12 638	14 649
	United States	161	207	89	2 429 718	2 734 268	6 094	6 848
Partners	Albania	204	204	92	39 275	42 466	4 743	5 102
	Argentina	219	229	88	457 294	519 733	5 804	6 680
	Brazil	837	886	90	2 133 035	2 368 438	19 877	22 326
	Bulgaria	187	188	96	51 819	54 145	5 280	5 508
	Colombia	352	363	93	507 178	544 862	11 164	12 045
	Costa Rica	191	193	89	35 525	39 930	4 582	5 187
	Croatia	163	164	92	41 912	45 473	6 153	6 675
	Cyprus*	117	131	93	8 719	9 344	5 078	5 458
	Hong Kong-China	147	156	93	62 059	66 665	4 659	5 004
	Indonesia	206	210	95	2 478 961	2 605 254	5 579	5 885
	Jordan	233	233	95	105 493	111 098	7 038	7 402
	Kazakhstan	218	218	99	206 053	208 411	5 808	5 874
	Latvia	211	213	91	14 579	16 039	5 276	5 785
	Liechtenstein	12	12	93	293	314	293	314
	Lithuania	216	216	92	30 429	33 042	4 618	5 018
	Macao-China	45	45	99	5 335	5 366	5 335	5 366
	Malaysia	164	164	94	405 983	432 080	5 197	5 529
	Montenegro	51	51	94	7 233	7 714	4 799	5 117
	Peru	240	243	96	398 193	414 728	6 035	6 291
	Qatar	157	164	100	10 966	10 996	10 966	10 996
	Romania	178	178	98	137 860	140 915	5 074	5 188
	Russian Federation	227	227	97	1 141 317	1 172 539	6 418	6 602
	Serbia	152	160	93	60 366	64 658	4 681	5 017
	Shanghai-China	155	155	98	83 821	85 127	6 374	6 467
	Singapore	172	176	94	47 465	50 330	5 546	5 887
	Chinese Taipei	163	163	96	281 799	292 542	6 046	6 279
	Thailand	239	240	99	695 088	702 818	6 606	6 681
	Tunisia	152	153	90	108 342	119 917	4 391	4 857
	United Arab Emirates	453	460	95	38 228	40 384	11 460	12 148
	Uruguay	180	180	90	35 800	39 771	5 315	5 904
	Viet Nam	162	162	100	955 222	956 517	4 959	4 966

Information for the adjudicated regions is available on line.
* See note at the beginning of this Annex.
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Table A2.3 shows the response rates for students and schools, before and after replacement.

- ***Column 1*** shows the *weighted participation rate of schools before replacement*. This is obtained by dividing Column 2 by Column 3, multiply by 100.
- ***Column 2*** shows the *weighted number of responding schools before school replacement* (weighted by student enrolment).
- ***Column 3*** shows the *weighted number of sampled schools before school replacement* (including both responding and non-responding schools, weighted by student enrolment).
- ***Column 4*** shows the *unweighted number of responding schools before school replacement*.
- ***Column 5*** shows the *unweighted number of responding and non-responding schools before school replacement.*
- ***Column 6*** shows the *weighted participation rate of schools after replacement*. This is obtained by dividing Column 7 by Column 8, multiply by 100.
- ***Column 7*** shows the *weighted number of responding schools after school replacement (weighted by student enrolment).*
- ***Column 8*** shows the *weighted number of schools sampled after school replacement* (including both responding and non-responding schools, weighted by student enrolment).
- ***Column 9*** shows the *unweighted number of responding schools after school replacement*.
- ***Column 10*** shows the *unweighted number of responding and non-responding schools after school replacement.*
- ***Column 11*** shows the *weighted student participation rate after replacement*. This is obtained by dividing Column 12 by Column 13, multiply by 100.
- ***Column 12*** shows the *weighted number of students assessed*.
- ***Column 13*** shows the *weighted number of students sampled* (including both students who were assessed and students who were absent on the day of the assessment).
- ***Column 14*** shows the *unweighted number of students assessed.* Note that any students in schools with student-response rates less than 50% were not included in these rates (both weighted and unweighted).
- ***Column 15*** shows the *unweighted number of students sampled* (including both students that were assessed and students who were absent on the day of the assessment). Note that any students in schools where fewer than half of the eligible students were assessed were not included in these rates (neither weighted nor unweighted).

Definition of schools

In some countries, sub-units within schools were sampled instead of schools and this may affect the estimation of the between-school variance components. In Austria, the Czech Republic, Germany, Hungary, Japan, Romania and Slovenia, schools with more than one study programme were split into the units delivering these programmes. In the Netherlands, for schools with both lower and upper secondary programmes, schools were split into units delivering each programme level. In the Flemish Community of Belgium, in the case of multi-campus schools, implantations (campuses) were sampled, whereas in the French Community, in the case of multi-campus schools, the larger administrative units were sampled. In Australia, for schools with more than one campus, the individual campuses were listed for sampling. In Argentina, Croatia and Dubai (United Arab Emirates), schools that had more than one campus had the locations listed for sampling. In Spain, the schools in the Basque region with multi-linguistic models were split into linguistic models for sampling.

Grade levels

Students assessed in PISA 2012 are at various grade levels. The percentage of students at each grade level is presented by country and economy in Table A2.4a and by gender within each country and economy in Table A2.4b.

[Part 1/1]

Table A2.4a Percentage of students at each grade level

		All students											
		7th grade		8th grade		9th grade		10th grade		11th grade		12th grade and above	
		%	S.E.	%	S.E.	%	S.E.	%	S.E.	%	S.E.	%	S.E.
OECD	Australia	0.0	(0.0)	0.1	(0.0)	10.8	(0.5)	70.0	(0.6)	19.1	(0.4)	0.0	(0.0)
	Austria	0.3	(0.1)	5.4	(0.7)	43.3	(0.9)	51.0	(1.0)	0.1	(0.0)	0.0	c
	Belgium	0.9	(0.1)	6.4	(0.5)	30.9	(0.6)	60.8	(0.6)	1.0	(0.1)	0.0	(0.0)
	Canada	0.1	(0.0)	1.1	(0.1)	13.2	(0.6)	84.6	(0.6)	1.0	(0.1)	0.1	(0.0)
	Chile	1.4	(0.3)	4.1	(0.6)	21.7	(0.8)	66.1	(1.2)	6.7	(0.3)	0.0	c
	Czech Republic	0.4	(0.1)	4.5	(0.4)	51.1	(1.2)	44.1	(1.3)	0.0	c	0.0	c
	Denmark	0.1	(0.0)	18.2	(0.8)	80.6	(0.8)	1.0	(0.2)	0.0	c	0.0	c
	Estonia	0.6	(0.2)	22.1	(0.7)	75.4	(0.7)	1.9	(0.3)	0.0	c	0.0	c
	Finland	0.7	(0.2)	14.2	(0.4)	85.0	(0.4)	0.0	c	0.1	(0.1)	0.0	c
	France	0.0	(0.0)	1.9	(0.3)	27.9	(0.7)	66.6	(0.7)	3.5	(0.3)	0.1	(0.1)
	Germany	0.6	(0.1)	10.0	(0.6)	51.9	(0.8)	36.7	(0.9)	0.8	(0.4)	0.0	c
	Greece	0.3	(0.1)	1.2	(0.3)	4.0	(0.7)	94.5	(1.0)	0.0	c	0.0	c
	Hungary	2.8	(0.5)	8.7	(0.9)	67.8	(0.9)	20.6	(0.6)	0.0	c	0.0	c
	Iceland	0.0	c	0.0	c	0.0	c	100.0	c	0.0	c	0.0	c
	Ireland	0.0	(0.0)	1.9	(0.2)	60.5	(0.8)	24.3	(1.2)	13.3	(1.0)	0.0	c
	Israel	0.0	(0.0)	0.3	(0.1)	17.1	(0.9)	81.7	(0.9)	0.8	(0.3)	0.0	c
	Italy	0.4	(0.1)	1.7	(0.2)	16.8	(0.6)	78.5	(0.7)	2.6	(0.2)	0.0	(0.0)
	Japan	0.0	c	0.0	c	0.0	c	100.0	c	0.0	c	0.0	c
	Korea	0.0	c	0.0	c	5.9	(0.8)	93.8	(0.8)	0.2	(0.1)	0.0	c
	Luxembourg	0.7	(0.1)	10.2	(0.2)	50.7	(0.1)	38.0	(0.1)	0.5	(0.1)	0.0	c
	Mexico	1.1	(0.1)	5.2	(0.3)	30.8	(1.0)	60.8	(1.1)	2.1	(0.3)	0.1	(0.0)
	Netherlands	0.0	c	3.6	(0.4)	46.7	(1.0)	49.2	(1.1)	0.5	(0.1)	0.0	c
	New Zealand	0.0	c	0.0	c	0.1	(0.1)	6.2	(0.4)	88.3	(0.5)	5.4	(0.4)
	Norway	0.0	c	0.0	c	0.4	(0.1)	99.4	(0.1)	0.2	(0.0)	0.0	c
	Poland	0.5	(0.1)	4.1	(0.4)	94.9	(0.4)	0.5	(0.2)	0.0	c	0.0	c
	Portugal	2.4	(0.3)	8.2	(0.7)	28.6	(1.6)	60.5	(2.1)	0.3	(0.1)	0.0	c
	Slovak Republic	1.7	(0.3)	4.5	(0.5)	39.5	(1.5)	52.7	(1.4)	1.6	(0.5)	0.0	c
	Slovenia	0.0	c	0.3	(0.2)	5.1	(0.8)	90.7	(0.8)	3.9	(0.2)	0.0	c
	Spain	0.1	(0.0)	9.8	(0.5)	24.1	(0.4)	66.0	(0.6)	0.0	(0.0)	0.0	c
	Sweden	0.0	(0.0)	3.7	(0.3)	94.0	(0.6)	2.2	(0.5)	0.0	c	0.0	c
	Switzerland	0.6	(0.1)	12.9	(0.8)	60.6	(1.0)	25.6	(1.0)	0.2	(0.1)	0.0	c
	Turkey	0.5	(0.2)	2.2	(0.3)	27.6	(1.2)	65.5	(1.2)	4.0	(0.3)	0.3	(0.1)
	United Kingdom	0.0	c	0.0	c	0.0	(0.0)	1.3	(0.3)	95.0	(0.3)	3.6	(0.1)
	United States	0.0	c	0.3	(0.1)	11.7	(1.1)	71.2	(1.1)	16.6	(0.8)	0.2	(0.1)
	OECD average	0.5	(0.0)	4.9	(0.1)	34.7	(0.1)	51.9	(0.2)	7.7	(0.1)	0.3	(0.0)
Partners	Albania	0.1	(0.1)	2.2	(0.3)	39.4	(2.4)	58.0	(2.5)	0.3	(0.1)	0.0	c
	Argentina	2.0	(0.5)	12.0	(1.2)	22.6	(1.4)	59.4	(2.1)	2.8	(0.6)	1.1	(0.7)
	Brazil	0.0	c	6.9	(0.5)	13.5	(0.7)	34.9	(1.0)	42.0	(1.0)	2.6	(0.2)
	Bulgaria	0.9	(0.2)	4.6	(0.5)	89.5	(0.7)	4.9	(0.4)	0.0	(0.0)	0.0	c
	Colombia	5.5	(0.6)	12.1	(0.7)	21.5	(0.8)	40.2	(0.9)	20.7	(1.0)	0.0	c
	Costa Rica	7.4	(0.9)	13.7	(0.9)	39.6	(1.3)	39.1	(1.8)	0.2	(0.1)	0.0	c
	Croatia	0.0	c	0.0	c	79.8	(0.4)	20.2	(0.4)	0.0	c	0.0	c
	Cyprus*	0.0	(0.0)	0.5	(0.1)	4.5	(0.1)	94.3	(0.1)	0.7	(0.0)	0.0	(0.0)
	Hong Kong-China	1.1	(0.1)	6.5	(0.4)	25.9	(0.7)	65.0	(0.9)	1.5	(1.4)	0.0	c
	Indonesia	1.9	(0.4)	8.3	(0.8)	37.7	(2.6)	47.7	(3.0)	3.9	(0.6)	0.6	(0.6)
	Jordan	0.1	(0.0)	1.1	(0.1)	6.0	(0.4)	92.9	(0.4)	0.0	c	0.0	c
	Kazakhstan	0.2	(0.1)	4.9	(0.5)	67.2	(1.9)	27.4	(2.0)	0.2	(0.1)	0.1	(0.1)
	Latvia	2.1	(0.4)	14.8	(0.7)	80.0	(0.8)	3.0	(0.4)	0.0	(0.0)	0.0	c
	Liechtenstein	4.9	(0.7)	14.2	(1.5)	66.3	(1.3)	14.6	(0.2)	0.0	c	0.0	c
	Lithuania	0.2	(0.1)	6.2	(0.6)	81.2	(0.7)	12.4	(0.7)	0.0	(0.0)	0.0	c
	Macao-China	5.4	(0.1)	16.4	(0.2)	33.2	(0.2)	44.6	(0.1)	0.4	(0.1)	0.0	(0.0)
	Malaysia	0.0	c	0.1	(0.0)	4.0	(0.5)	96.0	(0.5)	0.0	(0.0)	0.0	c
	Montenegro	0.0	c	0.1	(0.0)	79.5	(0.1)	20.4	(0.1)	0.0	c	0.0	c
	Peru	2.7	(0.4)	7.8	(0.5)	18.1	(0.7)	47.7	(0.9)	23.7	(0.8)	0.0	c
	Qatar	0.9	(0.0)	3.1	(0.1)	13.8	(0.1)	64.8	(0.1)	17.1	(0.1)	0.3	(0.0)
	Romania	0.2	(0.1)	7.4	(0.5)	87.2	(0.6)	5.1	(0.4)	0.0	c	0.0	c
	Russian Federation	0.6	(0.1)	8.1	(0.5)	73.8	(1.6)	17.4	(1.8)	0.1	(0.1)	0.0	c
	Serbia	0.1	(0.1)	1.5	(0.7)	96.7	(0.7)	1.7	(0.2)	0.0	c	0.0	c
	Shanghai-China	1.1	(0.2)	4.5	(0.6)	39.6	(1.5)	54.2	(1.3)	0.6	(0.1)	0.1	(0.1)
	Singapore	0.4	(0.1)	2.0	(0.2)	8.0	(0.3)	89.6	(0.3)	0.1	(0.1)	0.0	c
	Chinese Taipei	0.0	c	0.2	(0.1)	36.2	(0.7)	63.6	(0.7)	0.0	c	0.0	c
	Thailand	0.1	(0.0)	0.3	(0.1)	20.7	(1.0)	76.0	(1.1)	2.9	(0.5)	0.0	c
	Tunisia	5.0	(0.6)	11.8	(1.3)	20.6	(1.4)	56.7	(2.7)	5.9	(0.5)	0.0	c
	United Arab Emirates	0.9	(0.2)	2.8	(0.2)	11.3	(0.8)	61.9	(1.0)	22.2	(0.7)	0.9	(0.2)
	Uruguay	6.9	(0.8)	12.2	(0.6)	22.4	(1.0)	57.3	(1.5)	1.3	(0.2)	0.0	c
	Viet Nam	0.4	(0.2)	2.7	(0.7)	8.3	(1.7)	88.6	(2.3)	0.0	c	0.0	c

Information for the adjudicated regions is available on line.
* See note at the beginning of this Annex.
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[Part 1/2]

Table A2.4b Percentage of students at each grade level, by gender

		Boys											
		7th grade		8th grade		9th grade		10th grade		11th grade		12th grade and above	
		%	S.E.	%	S.E.	%	S.E.	%	S.E.	%	S.E.	%	S.E.
OECD	Australia	0.0	c	0.1	(0.0)	13.1	(0.9)	69.2	(0.9)	17.5	(0.6)	0.0	(0.0)
	Austria	0.3	(0.1)	6.0	(0.9)	44.8	(1.4)	48.9	(1.5)	0.0	c	0.0	c
	Belgium	1.0	(0.1)	7.1	(0.6)	33.8	(0.9)	57.1	(1.0)	1.0	(0.2)	0.0	(0.0)
	Canada	0.1	(0.1)	1.3	(0.2)	14.8	(0.8)	82.7	(0.8)	0.9	(0.1)	0.1	(0.1)
	Chile	1.4	(0.4)	5.0	(0.9)	24.2	(1.0)	63.1	(1.6)	6.4	(0.4)	0.0	c
	Czech Republic	0.7	(0.2)	5.5	(0.6)	54.9	(2.0)	39.0	(2.1)	0.0	c	0.0	c
	Denmark	0.1	(0.0)	23.4	(1.0)	75.7	(1.0)	0.8	(0.3)	0.0	c	0.0	c
	Estonia	0.8	(0.3)	25.7	(1.0)	71.7	(1.1)	1.7	(0.4)	0.0	c	0.0	c
	Finland	0.9	(0.4)	16.2	(0.6)	82.8	(0.7)	0.0	c	0.1	(0.1)	0.0	c
	France	0.1	(0.1)	2.3	(0.4)	30.8	(0.9)	63.5	(1.0)	3.2	(0.5)	0.1	(0.1)
	Germany	0.9	(0.2)	11.6	(0.7)	53.6	(1.1)	33.2	(1.2)	0.7	(0.3)	0.0	c
	Greece	0.4	(0.2)	1.8	(0.6)	4.8	(1.0)	93.0	(1.4)	0.0	c	0.0	c
	Hungary	3.9	(0.6)	12.1	(1.5)	67.1	(1.3)	17.0	(0.8)	0.0	c	0.0	c
	Iceland	0.0	c	0.0	c	0.0	c	100.0	c	0.0	c	0.0	c
	Ireland	0.0	c	2.4	(0.3)	63.6	(1.0)	21.1	(1.4)	13.0	(1.3)	0.0	c
	Israel	0.1	(0.1)	0.3	(0.1)	18.9	(1.3)	79.6	(1.3)	1.2	(0.5)	0.0	c
	Italy	0.5	(0.2)	2.1	(0.3)	19.3	(0.7)	75.8	(0.7)	2.3	(0.2)	0.0	c
	Japan	0.0	c	0.0	c	0.0	c	100.0	c	0.0	c	0.0	c
	Korea	0.0	c	0.0	c	6.4	(1.2)	93.4	(1.2)	0.2	(0.1)	0.0	c
	Luxembourg	0.7	(0.1)	10.7	(0.2)	51.1	(0.2)	37.0	(0.2)	0.6	(0.1)	0.0	c
	Mexico	1.3	(0.2)	6.3	(0.3)	33.0	(1.1)	57.2	(1.2)	2.1	(0.5)	0.0	(0.0)
	Netherlands	0.0	c	4.4	(0.6)	49.5	(1.1)	45.7	(1.2)	0.4	(0.1)	0.0	c
	New Zealand	0.0	c	0.0	c	0.2	(0.1)	7.0	(0.5)	88.0	(0.7)	4.8	(0.5)
	Norway	0.0	c	0.0	c	0.6	(0.1)	99.1	(0.1)	0.3	(0.0)	0.0	c
	Poland	0.9	(0.2)	5.7	(0.6)	93.0	(0.6)	0.4	(0.2)	0.0	c	0.0	c
	Portugal	2.6	(0.5)	9.9	(0.9)	30.1	(1.7)	57.0	(2.2)	0.4	(0.2)	0.0	c
	Slovak Republic	1.5	(0.3)	5.4	(0.8)	40.1	(2.0)	51.5	(2.1)	1.5	(0.5)	0.0	c
	Slovenia	0.0	c	0.4	(0.3)	6.3	(1.0)	90.2	(1.0)	3.1	(0.4)	0.0	c
	Spain	0.1	(0.1)	11.8	(0.6)	25.8	(0.6)	62.2	(0.7)	0.1	(0.1)	0.0	c
	Sweden	0.1	(0.1)	4.6	(0.5)	93.7	(0.8)	1.7	(0.6)	0.0	c	0.0	c
	Switzerland	0.5	(0.1)	13.9	(0.9)	60.6	(1.7)	24.7	(2.0)	0.2	(0.1)	0.0	c
	Turkey	0.3	(0.1)	2.6	(0.5)	33.2	(1.5)	60.3	(1.5)	3.2	(0.4)	0.3	(0.1)
	United Kingdom	0.0	c	0.0	c	0.0	(0.0)	1.7	(0.4)	94.7	(0.4)	3.7	(0.2)
	United States	0.0	c	0.4	(0.2)	14.6	(1.1)	69.8	(1.1)	14.9	(0.9)	0.3	(0.2)
	OECD average	0.6	(0.1)	5.9	(0.1)	35.6	(0.2)	50.1	(0.2)	7.5	(0.1)	0.3	(0.1)
Partners	Albania	0.1	(0.1)	2.9	(0.4)	42.9	(2.7)	53.8	(2.8)	0.2	(0.1)	0.0	c
	Argentina	2.8	(0.8)	15.0	(1.7)	25.8	(1.9)	52.6	(2.6)	3.0	(0.9)	0.8	(0.5)
	Brazil	0.0	c	9.0	(0.7)	15.8	(0.8)	36.1	(1.1)	37.2	(1.0)	1.9	(0.2)
	Bulgaria	1.3	(0.3)	5.8	(0.7)	88.2	(1.0)	4.6	(0.4)	0.0	c	0.0	c
	Colombia	7.4	(0.8)	13.5	(1.0)	22.1	(1.0)	38.8	(1.4)	18.2	(1.2)	0.0	c
	Costa Rica	9.3	(1.3)	16.4	(1.2)	38.5	(1.5)	35.7	(2.0)	0.0	(0.0)	0.0	c
	Croatia	0.0	c	0.0	c	82.0	(0.6)	18.0	(0.6)	0.0	c	0.0	c
	Cyprus*	0.0	(0.0)	0.5	(0.1)	4.7	(0.1)	94.0	(0.2)	0.7	(0.1)	0.0	c
	Hong Kong-China	1.2	(0.2)	6.9	(0.5)	27.5	(0.7)	63.0	(1.0)	1.4	(1.3)	0.0	c
	Indonesia	2.3	(0.4)	10.0	(1.1)	38.5	(3.0)	45.5	(3.7)	3.1	(0.6)	0.6	(0.6)
	Jordan	0.1	(0.1)	0.8	(0.2)	5.7	(0.6)	93.4	(0.6)	0.0	c	0.0	c
	Kazakhstan	0.3	(0.1)	5.5	(0.6)	68.4	(2.4)	25.4	(2.6)	0.2	(0.1)	0.2	(0.2)
	Latvia	3.6	(0.8)	18.0	(0.9)	76.4	(1.3)	2.0	(0.3)	0.0	(0.0)	0.0	c
	Liechtenstein	4.5	(1.2)	16.5	(2.1)	69.4	(2.2)	9.6	(0.6)	0.0	c	0.0	c
	Lithuania	0.2	(0.1)	7.3	(0.6)	82.2	(0.9)	10.4	(0.8)	0.0	(0.0)	0.0	c
	Macao-China	7.1	(0.2)	19.3	(0.2)	33.3	(0.2)	40.0	(0.2)	0.2	(0.1)	0.0	(0.0)
	Malaysia	0.0	c	0.1	(0.1)	5.1	(0.7)	94.7	(0.7)	0.0	c	0.0	c
	Montenegro	0.0	c	0.1	(0.1)	82.0	(0.3)	17.9	(0.3)	0.0	c	0.0	c
	Peru	3.1	(0.5)	9.1	(0.8)	19.5	(0.7)	46.2	(1.0)	22.1	(0.9)	0.0	c
	Qatar	1.2	(0.1)	3.6	(0.1)	14.0	(0.1)	64.6	(0.2)	16.1	(0.2)	0.4	(0.0)
	Romania	0.3	(0.2)	6.5	(0.6)	88.7	(0.7)	4.5	(0.4)	0.0	c	0.0	c
	Russian Federation	0.7	(0.2)	8.9	(0.7)	73.7	(1.5)	16.7	(1.8)	0.1	(0.1)	0.0	c
	Serbia	0.1	(0.1)	1.9	(0.9)	96.7	(1.0)	1.4	(0.2)	0.0	c	0.0	c
	Shanghai-China	1.3	(0.3)	5.3	(0.8)	41.6	(1.6)	51.2	(1.4)	0.6	(0.1)	0.0	(0.0)
	Singapore	0.4	(0.1)	2.0	(0.3)	8.3	(0.4)	89.3	(0.5)	0.0	(0.0)	0.0	c
	Chinese Taipei	0.0	c	0.2	(0.2)	37.4	(1.5)	62.4	(1.5)	0.0	c	0.0	c
	Thailand	0.1	(0.1)	0.4	(0.2)	22.9	(1.3)	74.1	(1.5)	2.5	(0.5)	0.0	c
	Tunisia	6.3	(0.8)	14.6	(1.6)	21.9	(1.6)	52.3	(3.0)	4.9	(0.5)	0.0	c
	United Arab Emirates	1.3	(0.3)	3.1	(0.3)	12.9	(0.9)	60.3	(1.2)	21.8	(1.0)	0.6	(0.1)
	Uruguay	9.4	(1.3)	13.1	(0.8)	24.0	(1.1)	52.4	(1.9)	1.2	(0.2)	0.0	c
	Viet Nam	0.7	(0.3)	3.5	(0.8)	10.5	(2.2)	85.3	(2.8)	0.0	c	0.0	c

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[Part 2/2]

Table A2.4b **Percentage of students at each grade level, by gender**

		Girls											
		7th grade		8th grade		9th grade		10th grade		11th grade		12th grade and above	
		%	S.E.	%	S.E.	%	S.E.	%	S.E.	%	S.E.	%	S.E.
OECD	Australia	0.0	(0.0)	0.2	(0.1)	8.3	(0.3)	70.8	(0.6)	20.7	(0.6)	0.0	(0.0)
	Austria	0.3	(0.1)	4.7	(0.7)	41.8	(1.3)	53.1	(1.4)	0.1	(0.1)	0.0	c
	Belgium	0.9	(0.1)	5.7	(0.5)	28.0	(0.7)	64.4	(0.8)	1.0	(0.2)	0.0	c
	Canada	0.1	(0.0)	0.9	(0.1)	11.5	(0.5)	86.4	(0.5)	1.2	(0.1)	0.0	(0.0)
	Chile	1.3	(0.3)	3.3	(0.6)	19.3	(1.0)	69.0	(1.2)	7.1	(0.4)	0.0	c
	Czech Republic	0.1	(0.1)	3.5	(0.5)	47.1	(2.0)	49.4	(2.1)	0.0	c	0.0	c
	Denmark	0.1	(0.0)	13.0	(0.9)	85.6	(0.9)	1.3	(0.3)	0.0	c	0.0	c
	Estonia	0.3	(0.1)	18.6	(0.8)	79.0	(0.9)	2.2	(0.4)	0.0	c	0.0	c
	Finland	0.5	(0.1)	12.0	(0.4)	87.3	(0.4)	0.0	c	0.2	(0.1)	0.0	c
	France	0.0	c	1.6	(0.3)	25.1	(1.1)	69.4	(1.1)	3.8	(0.4)	0.1	(0.1)
	Germany	0.3	(0.1)	8.2	(0.6)	50.2	(1.0)	40.4	(1.1)	0.8	(0.4)	0.0	c
	Greece	0.3	(0.1)	0.5	(0.1)	3.1	(0.7)	96.1	(0.8)	0.0	c	0.0	c
	Hungary	1.8	(0.7)	5.7	(0.8)	68.4	(1.1)	24.1	(0.8)	0.0	c	0.0	c
	Iceland	0.0	c	0.0	c	0.0	c	100.0	c	0.0	c	0.0	c
	Ireland	0.1	(0.1)	1.4	(0.2)	57.3	(1.0)	27.6	(1.4)	13.7	(1.2)	0.0	c
	Israel	0.0	(0.0)	0.2	(0.1)	15.5	(1.0)	83.8	(1.0)	0.4	(0.1)	0.0	c
	Italy	0.3	(0.1)	1.2	(0.2)	14.0	(0.6)	81.5	(0.8)	3.0	(0.3)	0.0	(0.0)
	Japan	0.0	c	0.0	c	0.0	c	100.0	c	0.0	c	0.0	c
	Korea	0.0	c	0.0	c	5.4	(1.1)	94.4	(1.1)	0.2	(0.1)	0.0	c
	Luxembourg	0.7	(0.1)	9.7	(0.2)	50.2	(0.2)	39.0	(0.2)	0.4	(0.1)	0.0	c
	Mexico	0.8	(0.1)	4.1	(0.3)	28.7	(1.0)	64.2	(1.1)	2.1	(0.3)	0.1	(0.1)
	Netherlands	0.0	c	2.7	(0.4)	43.8	(1.1)	53.0	(1.1)	0.5	(0.2)	0.0	c
	New Zealand	0.0	c	0.0	c	0.1	(0.1)	5.3	(0.4)	88.6	(0.6)	5.9	(0.6)
	Norway	0.0	c	0.0	c	0.2	(0.1)	99.8	(0.1)	0.0	c	0.0	c
	Poland	0.2	(0.1)	2.6	(0.3)	96.7	(0.4)	0.6	(0.2)	0.0	c	0.0	c
	Portugal	2.2	(0.3)	6.6	(0.7)	27.2	(1.6)	63.8	(2.2)	0.2	(0.1)	0.0	c
	Slovak Republic	1.9	(0.5)	3.5	(0.5)	38.8	(1.9)	54.0	(1.9)	1.8	(0.5)	0.0	c
	Slovenia	0.0	c	0.2	(0.2)	3.8	(0.9)	91.2	(1.0)	4.7	(0.5)	0.0	c
	Spain	0.1	(0.0)	7.8	(0.5)	22.3	(0.7)	69.9	(0.8)	0.0	(0.0)	0.0	c
	Sweden	0.0	c	2.8	(0.3)	94.4	(0.6)	2.8	(0.6)	0.0	c	0.0	c
	Switzerland	0.6	(0.2)	11.9	(1.0)	60.7	(1.7)	26.6	(1.8)	0.2	(0.1)	0.0	c
	Turkey	0.7	(0.3)	1.7	(0.3)	21.9	(1.2)	70.8	(1.1)	4.8	(0.4)	0.2	(0.1)
	United Kingdom	0.0	c	0.0	c	0.0	(0.0)	1.0	(0.3)	95.4	(0.3)	3.6	(0.2)
	United States	0.0	c	0.1	(0.1)	8.8	(1.2)	72.7	(1.3)	18.3	(0.9)	0.2	(0.1)
	OECD average	0.4	(0.0)	3.9	(0.1)	33.7	(0.2)	53.8	(0.2)	7.9	(0.1)	0.3	(0.1)
Partners	Albania	0.1	(0.1)	1.4	(0.4)	35.7	(2.6)	62.5	(2.6)	0.3	(0.1)	0.0	c
	Argentina	1.2	(0.3)	9.1	(0.9)	19.7	(1.3)	65.8	(1.9)	2.7	(0.4)	1.4	(0.8)
	Brazil	0.0	c	5.0	(0.4)	11.5	(0.7)	33.8	(1.0)	46.4	(1.1)	3.3	(0.2)
	Bulgaria	0.5	(0.2)	3.3	(0.5)	90.9	(0.7)	5.2	(0.5)	0.0	(0.0)	0.0	c
	Colombia	3.9	(0.6)	10.8	(0.7)	21.0	(0.9)	41.4	(1.1)	22.9	(1.1)	0.0	c
	Costa Rica	5.7	(0.8)	11.3	(0.8)	40.5	(1.3)	42.1	(1.7)	0.4	(0.2)	0.0	c
	Croatia	0.0	c	0.0	c	77.5	(0.6)	22.5	(0.6)	0.0	c	0.0	c
	Cyprus*	0.0	c	0.5	(0.1)	4.2	(0.2)	94.6	(0.2)	0.7	(0.1)	0.0	(0.0)
	Hong Kong-China	0.9	(0.2)	6.0	(0.6)	24.2	(0.8)	67.3	(1.0)	1.6	(1.5)	0.0	c
	Indonesia	1.5	(0.4)	6.4	(0.8)	36.8	(2.9)	50.0	(3.0)	4.7	(0.8)	0.5	(0.5)
	Jordan	0.0	(0.0)	1.3	(0.2)	6.3	(0.5)	92.4	(0.6)	0.0	c	0.0	c
	Kazakhstan	0.1	(0.1)	4.4	(0.5)	65.9	(1.9)	29.3	(2.1)	0.2	(0.1)	0.0	c
	Latvia	0.6	(0.2)	11.6	(0.8)	83.7	(1.1)	4.1	(0.7)	0.0	c	0.0	c
	Liechtenstein	5.3	(1.3)	11.5	(1.9)	62.8	(1.9)	20.4	(0.8)	0.0	c	0.0	c
	Lithuania	0.1	(0.1)	5.2	(0.6)	80.2	(0.9)	14.4	(0.8)	0.0	(0.0)	0.0	c
	Macao-China	3.5	(0.1)	13.3	(0.2)	33.1	(0.3)	49.5	(0.3)	0.7	(0.2)	0.0	c
	Malaysia	0.0	c	0.0	c	2.9	(0.4)	97.1	(0.4)	0.0	(0.1)	0.0	c
	Montenegro	0.0	c	0.0	c	77.1	(0.3)	22.9	(0.3)	0.0	c	0.0	c
	Peru	2.3	(0.5)	6.6	(0.6)	16.8	(1.0)	49.1	(1.2)	25.3	(1.0)	0.0	c
	Qatar	0.5	(0.1)	2.7	(0.1)	13.6	(0.1)	64.9	(0.2)	18.2	(0.1)	0.2	(0.0)
	Romania	0.1	(0.1)	8.3	(0.6)	85.9	(0.9)	5.7	(0.6)	0.0	c	0.0	c
	Russian Federation	0.6	(0.2)	7.3	(0.5)	73.9	(2.0)	18.1	(2.0)	0.1	(0.1)	0.0	c
	Serbia	0.1	(0.1)	1.0	(0.6)	96.8	(0.7)	2.0	(0.3)	0.0	c	0.0	c
	Shanghai-China	0.8	(0.2)	3.8	(0.5)	37.6	(1.8)	57.0	(1.8)	0.6	(0.1)	0.1	(0.1)
	Singapore	0.4	(0.1)	2.1	(0.2)	7.6	(0.4)	89.8	(0.4)	0.2	(0.1)	0.0	c
	Chinese Taipei	0.0	c	0.1	(0.1)	35.0	(1.5)	64.9	(1.4)	0.0	c	0.0	c
	Thailand	0.0	(0.0)	0.2	(0.1)	19.0	(1.2)	77.5	(1.2)	3.3	(0.5)	0.0	c
	Tunisia	3.9	(0.5)	9.3	(1.1)	19.4	(1.5)	60.6	(2.5)	6.7	(0.6)	0.0	c
	United Arab Emirates	0.6	(0.1)	2.6	(0.4)	9.7	(1.1)	63.4	(1.7)	22.6	(1.3)	1.2	(0.3)
	Uruguay	4.6	(0.6)	11.4	(0.8)	21.0	(1.1)	61.7	(1.5)	1.4	(0.2)	0.0	c
	Viet Nam	0.1	(0.1)	2.1	(0.6)	6.4	(1.5)	91.4	(1.9)	0.0	c	0.0	c

Information for the adjudicated regions is available on line.
* See note at the beginning of this Annex.
StatLink http://dx.doi.org/10.1787/888932937092

ANNEX A3
TECHNICAL NOTES ON ANALYSES IN THIS VOLUME

Standard errors and significance tests

The statistics in this report represent estimates of national performance based on samples of students, rather than values that could be calculated if every student in every country had answered every question. Consequently, it is important to measure the degree of uncertainty of the estimates. In PISA, each estimate has an associated degree of uncertainty, which is expressed through a standard error. The use of confidence intervals provides a way to make inferences about the population means and proportions in a manner that reflects the uncertainty associated with the sample estimates. From an observed sample statistic and assuming a normal distribution, it can be inferred that the corresponding population result would lie within the confidence interval in 95 out of 100 replications of the measurement on different samples drawn from the same population.

In many cases, readers are primarily interested in whether a given value in a particular country is different from a second value in the same or another country, e.g. whether girls in a country perform better than boys in the same country. In the tables and charts used in this report, differences are labelled as statistically significant when a difference of that size, smaller or larger, would be observed less than 5% of the time, if there were actually no difference in corresponding population values. Similarly, the risk of reporting a correlation as significant if there is, in fact, no correlation between two measures, is contained at 5%.

Throughout the report, significance tests were undertaken to assess the statistical significance of the comparisons made.

Gender differences and differences between subgroup means

Gender differences in student performance or other indices were tested for statistical significance. Positive differences indicate higher scores for boys while negative differences indicate higher scores for girls. Generally, differences marked in bold in the tables in this volume are statistically significant at the 95% confidence level.

Similarly, differences between other groups of students (e.g. native students and students with an immigrant background) were tested for statistical significance. The definitions of the subgroups can in general be found in the tables and the text accompanying the analysis. All differences marked in bold in the tables presented in Annex B of this report are statistically significant at the 95% level.

Range of ranks

To calculate the range of ranks for countries and economies (participants), data are simulated using the mean and standard error of the mean for each relevant participant to generate a distribution of possible values. Some 10 000 simulations are implemented and, based on these values, 10 000 possible rankings for each participant are produced. For each participant, the counts for each rank are aggregated from largest to smallest until they equal 9 500 or more. Then the range of ranks per participant is reported, including all the ranks that have been aggregated. This means that there is at least 95% confidence about the range of ranks, and it is safe to assume unimodality in this distribution of ranks. This method has been used in all cycles of PISA since 2003, including PISA 2012.

The main difference between the range of ranks (e.g. Figure I.2.14) and the comparison of participants' mean performance (e.g. Figure I.2.13) is that the former takes account of the asymmetry of the distribution of rank estimates, while the latter does not. Therefore, sometimes there is a slight difference between the range of ranks and counting the number of participants above a given participant, based on pairwise comparisons of the selected participants' performance. For instance, Canada and Poland have the same mean performance and the same set of participants whose mean score is not statistically different from theirs, based on Figure I.2.13; but the rank for Canada among OECD countries can be restricted to be, with 95% confidence, between 5th and 9th, while the range of ranks for Poland is between 4th and 10th (Figure I.2.14). Since it is safe to assume that the distribution of rank estimates for each country has a single mode (unimodality), the results of range of ranks for participants should be used when examining participants' rankings.

Standard errors in statistics estimated from multilevel models

For statistics based on multilevel models (such as the estimates of variance components and regression coefficients from two-level regression models) the standard errors are not estimated with the usual replication method which accounts for stratification and sampling rates from finite populations. Instead, standard errors are "model-based": their computation assumes that schools, and students within schools, are sampled at random (with sampling probabilities reflected in school and student weights) from a theoretical, infinite population of schools and students which complies with the model's parametric assumptions.

Standard errors in trend analyses of performance: Link error

Standard errors for performance trend estimates had to be adjusted because the equating procedure that allows scores in different PISA assessments to be compared introduces a form of random error that is related to performance changes on the link items. These more conservative standard errors (larger than standard errors that were estimated before the introduction of the link error) reflect not only the measurement precision and sampling variation as for the usual PISA results, but also the link error (see Annex A5 for a technical discussion of the link error).

Link items represent only a subset of all items used to derive PISA scores. If different items were chosen to equate PISA scores over time, the comparison of performance for a group of students across time could vary. As a result, standard errors for the estimates of the change over time in mathematics, reading or science performance of a particular group (e.g. a country or economy, a region, boys, girls, students with an immigrant background, students without an immigrant background, socio-economically advantaged students, students in public schools, etc.) include the link error in addition to the sampling and imputation error commonly added to estimates in performance for a particular year. Because the equating procedure adds uncertainty to the position in the distribution (a change in the intercept) but does not result in any change in the variance of a distribution, standard errors for location-invariant estimates do not include the link error. Location-invariant estimates include, for example, estimates for variances, regression coefficients for student- or school-level covariates, and correlation coefficients.

Figures in bold in the data tables for trends in performance presented in Annex B1 of this report indicate that the the change in performance for that particular group is statistically significantly different from 0 at the 95% confidence level. The standard errors used to calculate the statistical significance of the reported trend include the link error.

ANNEX A4
QUALITY ASSURANCE

Quality assurance procedures were implemented in all parts of PISA 2012, as was done for all previous PISA surveys.

The consistent quality and linguistic equivalence of the PISA 2012 assessment instruments were facilitated by providing countries with equivalent source versions of the assessment instruments in English and French and requiring countries (other than those assessing students in English and French) to prepare and consolidate two independent translations using both source versions. Precise translation and adaptation guidelines were supplied, also including instructions for selecting and training the translators. For each country, the translation and format of the assessment instruments (including test materials, marking guides, questionnaires and manuals) were verified by expert translators appointed by the PISA Consortium before they were used in the PISA 2012 Field Trial and Main Study. These translators' mother tongue was the language of instruction in the country concerned and they were knowledgeable about education systems. For further information on the PISA translation procedures, see the *PISA 2012 Technical Report* (OECD, forthcoming).

The survey was implemented through standardised procedures. The PISA Consortium provided comprehensive manuals that explained the implementation of the survey, including precise instructions for the work of School Co-ordinators and scripts for Test Administrators to use during the assessment sessions. Proposed adaptations to survey procedures, or proposed modifications to the assessment session script, were submitted to the PISA Consortium for approval prior to verification. The PISA Consortium then verified the national translation and adaptation of these manuals.

To establish the credibility of PISA as valid and unbiased and to encourage uniformity in administering the assessment sessions, Test Administrators in participating countries were selected using the following criteria: it was required that the Test Administrator not be the reading, mathematics or science instructor of any students in the sessions he or she would administer for PISA; it was recommended that the Test Administrator not be a member of the staff of any school where he or she would administer for PISA; and it was considered preferable that the Test Administrator not be a member of the staff of any school in the PISA sample. Participating countries organised an in-person training session for Test Administrators.

Participating countries and economies were required to ensure that: Test Administrators worked with the School Co-ordinator to prepare the assessment session, including updating student tracking forms and identifying excluded students; no extra time was given for the cognitive items (while it was permissible to give extra time for the student questionnaire); no instrument was administered before the two one-hour parts of the cognitive session; Test Administrators recorded the student participation status on the student tracking forms and filled in a Session Report Form; no cognitive instrument was permitted to be photocopied; no cognitive instrument could be viewed by school staff before the assessment session; and Test Administrators returned the material to the national centre immediately after the assessment sessions.

National Project Managers were encouraged to organise a follow-up session when more than 15% of the PISA sample was not able to attend the original assessment session.

National Quality Monitors from the PISA Consortium visited all national centres to review data-collection procedures. Finally, School Quality Monitors from the PISA Consortium visited a sample of seven schools during the assessment. For further information on the field operations, see the *PISA 2012 Technical Report* (OECD, forthcoming).

Marking procedures were designed to ensure consistent and accurate application of the marking guides outlined in the PISA Operations Manuals. National Project Managers were required to submit proposed modifications to these procedures to the Consortium for approval. Reliability studies to analyse the consistency of marking were implemented.

Software specially designed for PISA facilitated data entry, detected common errors during data entry, and facilitated the process of data cleaning. Training sessions familiarised National Project Managers with these procedures.

For a description of the quality assurance procedures applied in PISA and in the results, see the *PISA 2012 Technical Report* (OECD, forthcoming).

The results of adjudication showed that the PISA Technical Standards were fully met in all countries and economies that participated in PISA 2012, with the exception of Albania. Albania submitted parental occupation data that was incomplete and appeared inaccurate, since there was over-use of a narrow range of occupations. It was not possible to resolve these issues during the course of data cleaning, and as a result neither parental occupation data nor any indices which depend on this data are included in the international dataset. Results for Albania are omitted from any analyses which depend on these indices.

ANNEX A5
TECHNICAL DETAILS OF TRENDS ANALYSES

Comparing mathematics, reading and science performance across PISA cycles

The PISA 2003, 2006, 2009 and 2012 assessments use the same mathematics performance scale, which means that score points on this scale are directly comparable over time. The same is true for the reading performance scale used since PISA 2000 and the science performance scale used since PISA 2006. The comparability of scores across time is possible because of the use of link items that are common across assessments and can be used in the equating procedure to align performance scales. The items that are common across assessments are a subset of the total items that make up the assessment because PISA progressively renews its pool of items. As a result, out of a total of 110 items in the PISA 2012 mathematics assessment, 84 are linked to 2003 items, 48 to 2006 items and 35 to 2009 items. The number of PISA 2012 items linked to the PISA 2003 assessment is larger than the number linked to the PISA 2006 or the PISA 2009 assessments because mathematics was a major domain in PISA 2003 and PISA 2012. In PISA 2006 and PISA 2009, mathematics was a minor domain and all the mathematics items included in these assessments were link items. The 44 items in the PISA 2012 reading assessment are link items (44 are linked to 2009 items and 3 to 2000, 2006 and 2003). Only three items are needed to link PISA 2012 to PISA 2006 because equating is done in two-steps: PISA 2012 reading scores are equated to PISA 2009, which in turn is equated to PISA 2006 through 26 link items. The 53 items in the PISA 2012 science assessment are link items to PISA 2009 and PISA 2006. The *PISA 2012 Technical Report* (OECD, forthcoming) provides the technical details on equating the PISA 2012 mathematics, reading and science scales for trends purposes.

Link error

Standard errors for performance trend estimates had to be adjusted because the equating procedure that allows scores in different PISA assessments to be compared introduces a form of random error that is related to performance changes on the link items. These more conservative standard errors (larger than standard errors that were estimated before the introduction of the link error) reflect not only the measurement precision and sampling variation as for the usual PISA results, but also the link error provided in Table A5.1.

Link items represent only a subset of all items used to derive PISA scores. If different items were chosen to equate PISA scores over time, the comparison of performance for a group of students across time could vary. As a result, standard errors for the estimates of the change over time in mathematics, reading or science performance of a particular group (e.g. a country or economy, a region, boys, girls, students with an immigrant background, students without an immigrant background, socio-economically advantaged students, students in public schools, etc.) include the link error in addition to the sampling and imputation error commonly added to estimates in performance for a particular year. Because the equating procedure adds uncertainty to the position in the distribution (a change in the intercept) but does not result in any change in the variance of a distribution, standard errors for location-invariant estimates do not include the link error. Location-invariant estimates include, for example, estimates for variances, regression coefficients for student- or school-level covariates, and correlation coefficients.

Link error for scores between two PISA assessments

The following equations describe how link errors between two PISA assessments are calculated. Suppose we have L score points in K units. Use i to index items in a unit and j to index units so that $\hat{\mu}_{ij}^{y}$ is the estimated difficulty of item i in unit j for year y, and let for example to compare PISA 2006 and PISA 2003:

$$c_{ij} = \hat{\mu}_{ij}^{2006} - \hat{\mu}_{ij}^{2003}$$

The size (total number of score points) of unit j is m_j so that:

$$\sum_{j=1}^{K} m_j = L$$

and $$\bar{m} = \frac{1}{K}\sum_{j=1}^{K} m_j$$

Further let:

$$c_{.j} = \frac{1}{m_j}\sum_{j=1}^{m_j} c_{ij}$$

and

$$\bar{c} = \frac{1}{N}\sum_{j=1}^{K}\sum_{i=1}^{m_j} c_{ij}$$

then the link error, taking clustering into account, is as follows:

$$error_{2006,2003} = \sqrt{\frac{\sum_{j=1}^{K} m_j^2 (c_{.j} - \bar{c})^2}{K(K-1)\bar{m}^2}}$$

This approach for estimating the link errors was used in PISA 2006, PISA 2009 and PISA 2012. The link errors for comparisons of PISA 2012 results with previous assessments are shown in Table A5.1.

[Part 1/1]

Table A5.1 Link error for comparisons of performance between PISA 2012 and previous assessments

Comparison	Mathematics	Reading	Science
PISA 2000 to PISA 2012		5.923	
PISA 2003 to PISA 2012	1.931	5.604	
PISA 2006 to PISA 2012	2.084	5.580	3.512
PISA 2009 to PISA 2012	2.294	2.602	2.006

Note: Comparisons between PISA 2012 scores and previous assessments can only be made to when the subject first became a major domain. As a result, comparisons in mathematics performance between PISA 2012 and PISA 2000 are not possible, nor are comparisons in science performance between PISA 2012 and PISA 2000 or PISA 2003.
StatLink http://dx.doi.org/10.1787/888932937054

Link error for other types of comparisons of student performance

The link error for other comparisons of performance does not have a straightforward theoretical solution as does the link error for comparison between two PISA assessments. The link error between two PISA assessments, described above, can be used, however, to empirically estimate the magnitude of the link error for the comparison of the percentage of students in a particular proficiency level or the magnitude of the link error associated with the estimation of the annualised and curvilinear change.

The empirical estimation of these link errors uses the assumption that the magnitude of the link error follows a normal distribution with mean 0 and a standard deviation equal to the link error shown in Table A5.1. From this distribution, 500 errors are drawn and added to the first plausible value for each assessment prior to 2012. The estimate of interest (change in the percentage of students in a particular proficiency level or the annualised change) is calculated for each of the 500 replicates. The standard deviation of these 500 estimates is then used as the link error for the annualised change, the quadratic change, and the change in the percentage of students scoring in a particular proficiency level. The values used to adjust standard errors in the calculation of the change in the percentage of students in each proficiency Level group are shown in Table A5.2 and those used for the adjustment of the linear and quadratic terms in the regressions models used to estimate the annualised change and the curvilinear change are shown in Table A5.3.

Comparisons of performance: Difference between two assessments and annualised change

To evaluate the evolution of performance, analyses report the change in performance between two cycles and the annualised change in performance. Comparisons between two assessments (e.g. a country's/economy's change in performance between PISA 2003 and PISA 2012 or the change in performance of a subgroup) are calculated as:

$$\Delta_{2012-t} = PISA_{2012} - PISA_t$$

where $\Delta_{2012\text{-}t}$ is the difference in performance between PISA 2012 and a previous PISA assessment, where t can take any of the following values: 2000, 2003, 2006 or 2009. $PISA_{2012}$ is the mathematics, reading or science score observed in PISA 2012, and $PISA_t$ is the mathematics, reading or science score observed in a previous assessment (2000, 2003, 2006 or 2009). The standard error of the change in performance $\boldsymbol{\sigma}(\Delta_{2012\text{-}t})$ is:

$$\sigma(\Delta_{2012-t}) = \sqrt{\sigma_{2012}^2 + \sigma_t^2 + error_{2012,t}^2}$$

where $\boldsymbol{\sigma}_{2012}$ is the standard error observed for $PISA_{2012}$, $\boldsymbol{\sigma}_t$ is the standard error observed for $PISA_t$ and $error_{2012,t}$ is the link error for comparisons of mathematics, reading or science performance between the PISA 2012 assessment and a previous (t) assessment. The value for $error_{2012,t}$ is shown in Table A5.1.

A second set of analyses reported in PISA relate to annualised changes in performance. The annualised change is the average annual rate of change observed through a country's/economy's participation in PISA. The annualised change is the average rate of change for a country's/economy's average mathematics, reading and science scores throughout their participation in PISA assessments. Thus, a positive annualised change of x points indicates that the country/economy has improved in performance by x points per year since its earliest comparable PISA results participated in PISA. For countries and economies that have participated in only two assessments, the annualised change is equal to the difference between the two assessments, divided by the number of years that passed between the assessments.

[Part 1/3]

Table A5.2 Link error for comparisons of proficiency levels between PISA 2012 and previous assessments

		Mathematics comparison between PISA 2012 and…									
		PISA 2003						PISA 2006		PISA 2009	
		Below Level 2			Level 5 or above			Below Level 2	Level 5 or above	Below Level 2	Level 5 or above
		All	Boys	Girls	All	Boys	Girls	All	All	All	All
OECD	Australia	0.534	0.462	0.612	0.435	0.477	0.393	0.588	0.464	0.634	0.498
	Austria	0.566	0.567	0.579	0.501	0.537	0.470	0.610	0.530	m	m
	Belgium	0.484	0.476	0.495	0.556	0.572	0.543	0.521	0.596	0.556	0.637
	Canada	0.457	0.385	0.530	0.539	0.583	0.498	0.484	0.577	0.518	0.615
	Chile	m	m	m	m	m	m	0.934	0.094	0.995	0.099
	Czech Republic	0.532	0.410	0.670	0.437	0.429	0.456	0.582	0.455	0.630	0.486
	Denmark	0.601	0.554	0.657	0.379	0.400	0.359	0.653	0.402	0.703	0.430
	Estonia	m	m	m	m	m	m	0.457	0.538	0.490	0.577
	Finland	0.400	0.452	0.348	0.445	0.435	0.465	0.429	0.485	0.462	0.520
	France	0.541	0.568	0.519	0.471	0.487	0.462	0.587	0.497	0.631	0.528
	Germany	0.445	0.404	0.494	0.518	0.554	0.482	0.482	0.543	0.517	0.586
	Greece	1.029	0.927	1.133	0.192	0.240	0.149	1.099	0.206	1.163	0.221
	Hungary	0.640	0.586	0.699	0.374	0.387	0.370	0.680	0.397	0.723	0.428
	Iceland	0.560	0.567	0.555	0.419	0.370	0.477	0.594	0.447	0.640	0.481
	Ireland	0.542	0.440	0.655	0.426	0.509	0.353	0.584	0.459	0.627	0.491
	Israel	m	m	m	m	m	m	0.785	0.376	0.836	0.399
	Italy	0.635	0.562	0.714	0.350	0.427	0.270	0.683	0.375	0.735	0.402
	Japan	0.421	0.365	0.487	0.740	0.787	0.694	0.448	0.788	0.479	0.843
	Korea	0.326	0.300	0.365	0.660	0.618	0.714	0.355	0.727	0.383	0.774
	Luxembourg	0.555	0.607	0.509	0.377	0.445	0.312	0.603	0.397	0.652	0.426
	Mexico	0.998	0.998	0.999	0.062	0.088	0.038	1.079	0.064	1.154	0.067
	Netherlands	0.473	0.446	0.504	0.622	0.720	0.522	0.507	0.659	0.541	0.698
	New Zealand	0.657	0.691	0.632	0.420	0.497	0.344	0.706	0.451	0.759	0.478
	Norway	0.600	0.524	0.683	0.329	0.283	0.385	0.642	0.347	0.683	0.374
	Poland	0.537	0.602	0.486	0.574	0.639	0.515	0.572	0.624	0.615	0.669
	Portugal	0.516	0.483	0.556	0.458	0.531	0.387	0.566	0.482	0.608	0.508
	Slovak Republic	0.691	0.698	0.694	0.286	0.331	0.243	0.721	0.319	0.771	0.343
	Slovenia	m	m	m	m	m	m	0.711	0.491	0.767	0.520
	Spain	0.619	0.543	0.699	0.377	0.464	0.290	0.671	0.402	0.714	0.431
	Sweden	0.696	0.661	0.735	0.296	0.297	0.302	0.757	0.324	0.814	0.346
	Switzerland	0.414	0.278	0.555	0.636	0.672	0.606	0.446	0.682	0.478	0.730
	Turkey	1.008	0.911	1.111	0.220	0.289	0.154	1.085	0.235	1.158	0.253
	United Kingdom	m	m	m	m	m	m	0.575	0.317	0.628	0.348
	United States	0.735	0.697	0.777	0.382	0.409	0.358	0.787	0.404	0.836	0.430
Partners	Albania	m	m	m	m	m	m	m	m	0.810	0.033
	Argentina	m	m	m	m	m	m	0.906	0.019	0.970	0.021
	Brazil	0.900	1.042	0.773	0.068	0.081	0.059	0.968	0.072	1.031	0.075
	Bulgaria	m	m	m	m	m	m	0.777	0.230	0.830	0.245
	Colombia	m	m	m	m	m	m	0.778	0.022	0.829	0.024
	Costa Rica	m	m	m	m	m	m	m	m	1.179	0.043
	Croatia	m	m	m	m	m	m	0.804	0.248	0.859	0.263
	Dubai (UAE)	m	m	m	m	m	m	m	m	0.731	0.390
	Hong Kong-China	0.250	0.224	0.287	0.805	0.695	0.940	0.277	0.864	0.295	0.917
	Indonesia	0.715	0.662	0.776	0.025	0.021	0.036	0.758	0.025	0.812	0.026
	Jordan	m	m	m	m	m	m	1.017	0.052	1.081	0.053
	Kazakhstan	m	m	m	m	m	m	m	m	1.216	0.060
	Latvia	0.638	0.725	0.557	0.439	0.412	0.469	0.677	0.455	0.725	0.484
	Liechtenstein	0.552	0.680	0.479	1.055	1.440	0.697	0.579	1.065	0.610	1.147
	Lithuania	m	m	m	m	m	m	0.863	0.337	0.927	0.364
	Macao-China	0.343	0.309	0.383	0.697	0.754	0.643	0.369	0.755	0.395	0.806
	Malaysia	m	m	m	m	m	m	m	m	0.984	0.091
	Montenegro	m	m	m	m	m	m	0.840	0.064	0.891	0.069
	Peru	m	m	m	m	m	m	m	m	0.760	0.055
	Qatar	m	m	m	m	m	m	0.577	0.082	0.616	0.089
	Romania	m	m	m	m	m	m	1.101	0.164	1.169	0.176
	Russian Federation	0.804	0.890	0.723	0.344	0.321	0.375	0.871	0.363	0.933	0.392
	Serbia	m	m	m	m	m	m	0.939	0.157	1.011	0.168
	Shanghai-China	m	m	m	m	m	m	m	m	0.194	0.776
	Singapore	m	m	m	m	m	m	m	m	0.293	0.894
	Chinese Taipei	m	m	m	m	m	m	0.327	0.625	0.354	0.673
	Thailand	0.911	1.048	0.810	0.085	0.063	0.108	0.974	0.093	1.039	0.104
	Tunisia	0.804	0.643	0.955	0.056	0.040	0.074	0.857	0.059	0.911	0.062
	United Arab Emirates*	m	m	m	m	m	m	m	m	0.942	0.112
	Uruguay	0.817	0.793	0.846	0.065	0.105	0.035	0.881	0.069	0.944	0.075

Note: The link error is calculated empirically by adding a random error component from a normal distribution with mean equal to zero and standard deviation equal to those shown in Table A5.1 to each student's scores in PISA 2000, PISA 2003, PISA 2006 or PISA 2009. Each country's percentage of students in each proficiency level band are then calculated for each of 500 replications. The standard deviation in the observed coefficients is the result of the added error and is the reported link error.

* United Arab Emirates excluding Dubai.

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[Part 2/3]

Table A5.2 Link error for comparisons of proficiency levels between PISA 2012 and previous assessments

		Reading comparison between PISA 2012 and…											
		PISA 2000						PISA 2003		PISA 2006		PISA 2009	
		Below Level 2			Level 5 or above			Below Level 2	Level 5 or above	Below Level 2	Level 5 or above	Below Level 2	Level 5 or above
		All	Boys	Girls	All	Boys	Girls	All	All	All	All	All	All
OECD	Australia	1.294	1.569	1.008	1.293	1.033	1.570	1.289	1.282	1.246	1.254	0.601	0.599
	Austria	1.488	1.772	1.216	0.968	0.691	1.248	1.482	0.959	1.431	0.943	m	m
	Belgium	1.177	1.243	1.114	1.392	1.162	1.627	1.182	1.380	1.143	1.350	0.551	0.656
	Canada	1.057	1.269	0.847	1.457	1.175	1.741	1.058	1.449	1.016	1.410	0.525	0.676
	Chile	2.510	2.601	2.427	0.121	0.067	0.174	m	m	2.423	0.118	1.200	0.051
	Czech Republic	1.615	1.871	1.355	0.919	0.591	1.269	1.609	0.914	1.568	0.901	0.737	0.429
	Denmark	1.375	1.721	1.031	0.854	0.584	1.131	1.372	0.846	1.320	0.827	0.603	0.419
	Estonia	m	m	m	m	m	m	m	m	1.011	1.194	0.391	0.602
	Finland	1.197	1.858	0.502	1.601	1.038	2.199	1.200	1.588	1.161	1.551	0.510	0.730
	France	1.119	1.282	0.968	1.326	1.121	1.526	1.115	1.321	1.077	1.288	0.485	0.603
	Germany	1.269	1.487	1.046	1.375	1.026	1.741	1.271	1.353	1.232	1.334	0.594	0.648
	Greece	1.527	1.937	1.130	0.784	0.603	0.964	1.524	0.776	1.478	0.765	0.729	0.375
	Hungary	1.353	1.619	1.109	0.955	0.774	1.136	1.352	0.947	1.314	0.933	0.574	0.439
	Iceland	1.588	1.826	1.348	0.889	0.603	1.210	1.576	0.882	1.537	0.865	0.755	0.466
	Ireland	1.213	1.474	0.947	1.510	1.184	1.851	1.220	1.511	1.177	1.466	0.569	0.766
	Israel	1.355	1.274	1.447	1.145	0.950	1.338	m	m	1.316	1.111	0.619	0.568
	Italy	1.468	1.630	1.295	1.040	0.816	1.281	1.463	1.032	1.418	1.011	0.678	0.482
	Japan	0.831	0.876	0.794	1.743	1.572	1.937	0.834	1.734	0.799	1.692	0.391	0.828
	Korea	0.845	1.006	0.668	1.832	1.657	2.037	0.838	1.822	0.812	1.785	0.414	0.904
	Luxembourg	m	m	m	m	m	m	1.460	1.130	1.415	1.112	0.663	0.543
	Mexico	2.844	2.892	2.802	0.097	0.076	0.117	2.836	0.036	2.751	0.093	1.308	0.052
	Netherlands	m	m	m	m	m	m	1.350	1.404	1.312	1.370	0.661	0.661
	New Zealand	1.323	1.581	1.061	1.367	1.300	1.443	1.322	1.360	1.280	1.328	0.654	0.618
	Norway	1.259	1.569	0.945	1.236	0.840	1.658	1.254	1.231	1.210	1.204	0.514	0.526
	Poland	1.040	1.370	0.729	1.223	0.902	1.532	1.038	1.212	0.996	1.187	0.488	0.544
	Portugal	1.410	1.671	1.147	1.064	0.746	1.391	1.408	1.059	1.353	1.036	0.666	0.506
	Slovak Republic	m	m	m	m	m	m	1.775	0.717	1.714	0.706	0.804	0.343
	Slovenia	m	m	m	m	m	m	m	m	1.790	0.647	0.858	0.259
	Spain	1.539	1.682	1.400	0.824	0.641	1.016	1.532	0.815	1.483	0.803	0.669	0.380
	Sweden	1.509	1.831	1.186	1.023	0.719	1.339	1.502	1.018	1.455	0.995	0.729	0.510
	Switzerland	1.401	1.744	1.062	1.265	0.835	1.702	1.406	1.255	1.359	1.222	0.661	0.548
	Turkey	m	m	m	m	m	m	2.157	0.589	2.082	0.581	1.036	0.248
	United Kingdom	m	m	m	m	m	m	m	m	1.251	1.008	0.578	0.463
	United States	1.448	1.836	1.053	1.017	0.804	1.241	1.441	1.008	m	m	0.622	0.455
Partners	Albania	2.316	2.059	2.609	0.197	0.191	0.211	m	m	m	m	1.104	0.080
	Argentina	2.544	2.469	2.624	0.139	0.113	0.175	m	m	2.471	0.136	1.228	0.062
	Brazil	2.716	2.627	2.800	0.124	0.068	0.178	2.707	0.123	2.633	0.121	1.285	0.063
	Bulgaria	1.542	1.600	1.486	0.556	0.250	0.891	m	m	1.505	0.539	0.682	0.275
	Colombia	m	m	m	m	m	m	m	m	2.731	0.079	1.311	0.032
	Costa Rica	m	m	m	m	m	m	m	m	m	m	1.237	0.065
	Croatia	m	m	m	m	m	m	m	m	1.625	0.739	0.739	0.340
	Dubai (UAE)	m	m	m	m	m	m	m	m	m	m	0.987	0.295
	Hong Kong-China	0.758	0.837	0.673	2.017	1.723	2.366	0.762	1.996	0.734	1.961	0.364	0.886
	Indonesia	3.255	2.874	3.652	c	c	c	3.230	0.023	3.151	0.023	1.559	0.008
	Jordan	m	m	m	m	m	m	m	m	2.626	0.094	1.285	0.054
	Kazakhstan	m	m	m	m	m	m	m	m	m	m	1.356	0.002
	Latvia	1.591	2.138	1.043	0.689	0.327	1.066	1.585	0.681	1.532	0.664	0.749	0.302
	Liechtenstein	1.187	1.124	1.373	1.712	1.318	2.214	1.170	1.709	1.132	1.676	0.750	0.900
	Lithuania	m	m	m	m	m	m	m	m	1.708	0.602	0.805	0.324
	Macao-China	m	m	m	m	m	m	1.382	1.157	1.346	1.130	0.651	0.526
	Malaysia	m	m	m	m	m	m	m	m	m	m	1.303	0.015
	Montenegro	m	m	m	m	m	m	m	m	2.567	0.215	1.267	0.075
	Peru	2.488	2.406	2.571	0.132	c	0.175	m	m	m	m	1.161	0.058
	Qatar	m	m	m	m	m	m	m	m	1.958	0.256	0.940	0.125
	Romania	2.498	2.587	2.417	0.330	0.230	0.431	m	m	2.411	0.325	1.196	0.177
	Russian Federation	2.090	2.393	1.791	0.666	0.447	0.895	2.088	0.659	2.031	0.643	1.069	0.314
	Serbia	m	m	m	m	m	m	m	m	2.254	0.431	1.099	0.221
	Shanghai-China	m	m	m	m	m	m	m	m	m	m	0.209	1.133
	Singapore	m	m	m	m	m	m	m	m	m	m	0.375	0.985
	Chinese Taipei	m	m	m	m	m	m	m	m	1.034	1.575	0.544	0.744
	Thailand	2.755	3.240	2.379	0.138	0.038	0.218	2.754	0.135	2.671	0.136	1.289	0.054
	Tunisia	m	m	m	m	m	m	2.586	0.057	2.513	0.056	1.265	0.041
	United Arab Emirates*	m	m	m	m	m	m	m	m	m	m	1.190	0.084
	Uruguay	m	m	m	m	m	m	2.506	0.176	2.431	0.172	1.261	0.097

Note: The link error is calculated empirically by adding a random error component from a normal distribution with mean equal to zero and standard deviation equal to those shown in Table A5.1 to each student's scores in PISA 2000, PISA 2003, PISA 2006 or PISA 2009. Each country's percentage of students in each proficiency level band are then calculated for each of 500 replications. The standard deviation in the observed coefficients is the result of the added error and is the reported link error.

* United Arab Emirates excluding Dubai.

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[Part 3/3]

Table A5.2 Link error for comparisons of proficiency levels between PISA 2012 and previous assessments

		Science comparison between PISA 2012 and…							
		PISA 2006						PISA 2009	
		Below Level 2			Level 5 or above			Below Level 2	Level 5 or above
		All	Boys	Girls	All	Boys	Girls	All	All
OECD	Australia	0.702	0.699	0.708	0.816	0.779	0.855	0.419	0.486
	Austria	0.935	0.912	0.963	0.704	0.742	0.669	m	m
	Belgium	0.805	0.748	0.867	0.767	0.764	0.772	0.451	0.433
	Canada	0.584	0.585	0.584	0.856	0.933	0.783	0.338	0.478
	Chile	1.563	1.488	1.639	0.143	0.207	0.087	0.888	0.079
	Czech Republic	0.836	0.719	0.970	0.605	0.444	0.786	0.456	0.361
	Denmark	0.922	0.872	0.975	0.519	0.573	0.478	0.540	0.277
	Estonia	0.506	0.560	0.456	0.933	0.929	0.941	0.310	0.518
	Finland	0.457	0.518	0.398	1.040	0.864	1.236	0.259	0.585
	France	0.830	0.761	0.899	0.634	0.718	0.562	0.489	0.326
	Germany	0.717	0.676	0.768	0.892	0.970	0.814	0.430	0.501
	Greece	1.222	1.308	1.146	0.279	0.342	0.224	0.722	0.165
	Hungary	1.073	1.186	0.971	0.606	0.677	0.542	0.639	0.365
	Iceland	0.940	0.930	0.957	0.484	0.496	0.476	0.486	0.288
	Ireland	0.748	0.826	0.680	0.677	0.691	0.668	0.425	0.401
	Israel	0.957	0.877	1.038	0.557	0.736	0.388	0.537	0.337
	Italy	1.014	0.959	1.075	0.516	0.566	0.465	0.607	0.303
	Japan	0.499	0.521	0.478	1.093	1.285	0.888	0.313	0.612
	Korea	0.499	0.586	0.404	0.976	1.129	0.809	0.293	0.584
	Luxembourg	0.947	0.751	1.156	0.650	0.603	0.705	0.548	0.386
	Mexico	2.072	1.952	2.190	0.022	0.028	0.017	1.195	0.014
	Netherlands	0.879	0.668	1.106	0.911	0.968	0.856	0.541	0.548
	New Zealand	0.796	0.677	0.923	0.803	0.900	0.707	0.433	0.451
	Norway	0.864	0.812	0.921	0.551	0.521	0.585	0.486	0.298
	Poland	0.620	0.708	0.545	0.813	0.795	0.835	0.334	0.484
	Portugal	0.953	0.928	0.982	0.422	0.442	0.407	0.522	0.221
	Slovak Republic	1.013	1.100	0.924	0.424	0.463	0.386	0.566	0.253
	Slovenia	0.918	1.222	0.600	0.758	0.832	0.685	0.542	0.414
	Spain	0.884	0.840	0.932	0.501	0.591	0.411	0.517	0.286
	Sweden	0.973	0.918	1.033	0.454	0.447	0.466	0.560	0.254
	Switzerland	0.740	0.725	0.760	0.712	0.665	0.765	0.443	0.389
	Turkey	1.492	1.514	1.480	0.246	0.296	0.203	0.870	0.130
	United Kingdom	0.718	0.648	0.790	0.808	0.862	0.768	0.411	0.452
	United States	0.938	0.946	0.938	0.507	0.546	0.476	0.527	0.288
Partners	Albania	m	m	m	m	m	m	0.808	0.051
	Argentina	1.800	1.660	1.941	0.053	0.066	0.047	1.025	0.027
	Brazil	1.755	1.616	1.882	0.038	0.049	0.034	1.019	0.017
	Bulgaria	1.207	1.248	1.169	0.264	0.249	0.286	0.723	0.149
	Colombia	1.891	2.043	1.768	0.012	0.022	0.004	1.111	0.005
	Costa Rica	m	m	m	m	m	m	1.026	0.036
	Croatia	0.965	1.036	0.895	0.456	0.465	0.452	0.572	0.284
	Dubai (UAE)	m	m	m	m	m	m	0.720	0.182
	Hong Kong-China	0.299	0.304	0.296	1.454	1.556	1.341	0.167	0.873
	Indonesia	1.740	1.763	1.728	c	c	c	0.932	c
	Jordan	1.669	1.530	1.808	0.051	0.057	0.053	0.936	0.028
	Kazakhstan	m	m	m	m	m	m	1.048	0.025
	Latvia	0.953	1.016	0.898	0.460	0.470	0.457	0.566	0.288
	Liechtenstein	0.597	0.867	0.380	0.728	0.928	0.584	0.269	0.423
	Lithuania	0.869	0.924	0.819	0.501	0.382	0.628	0.489	0.320
	Macao-China	0.685	0.640	0.742	0.656	0.820	0.494	0.434	0.383
	Malaysia	m	m	m	m	m	m	1.058	0.026
	Montenegro	1.689	1.595	1.793	0.067	0.071	0.070	1.035	0.042
	Peru	m	m	m	m	m	m	0.822	0.000
	Qatar	1.126	0.940	1.328	0.132	0.124	0.143	0.657	0.071
	Romania	1.861	1.923	1.810	0.129	0.129	0.130	1.122	0.094
	Russian Federation	1.298	1.333	1.267	0.398	0.390	0.407	0.801	0.230
	Serbia	1.482	1.599	1.369	0.117	0.115	0.125	0.844	0.061
	Shanghai-China	m	m	m	m	m	m	0.150	1.006
	Singapore	m	m	m	m	m	m	0.307	0.650
	Chinese Taipei	0.751	0.742	0.763	0.764	0.788	0.747	0.480	0.426
	Thailand	1.781	1.899	1.696	0.135	0.092	0.172	1.060	0.078
	Tunisia	1.794	1.703	1.877	0.022	0.033	0.021	1.049	0.014
	United Arab Emirates*	m	m	m	m	m	m	0.758	0.075
	Uruguay	1.352	1.225	1.468	0.096	0.157	0.049	0.760	0.052

Note: The link error is calculated empirically by adding a random error component from a normal distribution with mean equal to zero and standard deviation equal to those shown in Table A5.1 to each student's scores in PISA 2000, PISA 2003, PISA 2006 or PISA 2009. Each country's percentage of students in each proficiency level band are then calculated for each of 500 replications. The standard deviation in the observed coefficients is the result of the added error and is the reported link error.
* United Arab Emirates excluding Dubai.
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[Part 1/1]

Table A5.3 Link error for comparisons of annualised and curvilinear change between PISA 2012 and previous assessments

		Comparisons between PISA 2012 and all previous comparable assessments in…					
		Mathematics		Reading		Science	
		Linear term	Quadratic term	Linear term	Quadratic term	Linear term	Quadratic term
		Error	Error	Error	Error	Error	Error
OECD	Australia	0.192	0.092	0.194	0.149	0.595	0.168
	Austria	0.195	0.091	0.193	0.148	0.594	0.168
	Belgium	0.191	0.091	0.194	0.147	0.597	0.168
	Canada	0.199	0.092	0.187	0.148	0.592	0.168
	Chile	0.305	0.185	0.292	0.169	0.605	0.168
	Czech Republic	0.183	0.088	0.237	0.147	0.609	0.168
	Denmark	0.205	0.094	0.187	0.149	0.588	0.168
	Estonia	0.297	0.185	0.481	0.459	0.610	0.168
	Finland	0.195	0.092	0.193	0.148	0.593	0.168
	France	0.189	0.090	0.206	0.148	0.599	0.168
	Germany	0.189	0.084	0.305	0.145	0.635	0.168
	Greece	0.195	0.091	0.209	0.150	0.592	0.168
	Hungary	0.194	0.092	0.193	0.149	0.594	0.168
	Iceland	0.196	0.092	0.188	0.147	0.595	0.168
	Ireland	0.196	0.091	0.191	0.149	0.593	0.168
	Israel	0.330	0.185	0.235	0.172	0.593	0.168
	Italy	0.191	0.091	0.200	0.148	0.597	0.168
	Japan	0.194	0.092	0.202	0.150	0.592	0.168
	Korea	0.199	0.094	0.187	0.149	0.590	0.168
	Luxembourg	0.203	0.094	0.184	0.148	0.590	0.168
	Mexico	0.202	0.094	0.186	0.149	0.589	0.168
	Netherlands	0.194	0.091	0.189	0.148	0.594	0.168
	New Zealand	0.191	0.092	0.193	0.148	0.596	0.168
	Norway	0.199	0.092	0.186	0.147	0.593	0.168
	Poland	0.185	0.088	0.231	0.148	0.606	0.168
	Portugal	0.203	0.093	0.187	0.150	0.587	0.168
	Slovak Republic	0.184	0.089	0.320	0.223	0.607	0.168
	Slovenia	0.306	0.185	0.460	0.459	0.605	0.168
	Spain	0.194	0.092	0.198	0.148	0.595	0.168
	Sweden	0.191	0.090	0.191	0.146	0.599	0.168
	Switzerland	0.186	0.089	0.203	0.147	0.603	0.168
	Turkey	0.216	0.096	0.287	0.219	0.586	0.168
	United Kingdom	0.194	0.091	0.190	0.148	0.595	0.168
	United States	0.198	0.092	0.188	0.147	0.593	0.168
Partners	Albania	0.748	m	0.238	0.205	0.678	m
	Argentina	0.340	0.185	0.228	0.171	0.590	0.168
	Brazil	0.205	0.094	0.199	0.151	0.586	0.168
	Bulgaria	0.318	0.185	0.281	0.168	0.599	0.168
	Colombia	0.326	0.185	0.428	0.459	0.595	0.168
	Costa Rica	0.748	m	0.848	m	0.678	m
	Croatia	0.317	0.185	0.440	0.459	0.599	0.168
	Dubai (UAE)	0.748	m	0.848	m	0.678	m
	Hong Kong-China	0.195	0.092	0.201	0.177	0.593	0.168
	Indonesia	0.234	0.095	0.262	0.176	0.581	0.168
	Jordan	0.346	0.185	0.413	0.459	0.588	0.168
	Kazakhstan	0.748	m	0.848	m	0.678	m
	Latvia	0.184	0.086	0.255	0.148	0.614	0.168
	Liechtenstein	0.239	0.095	0.239	0.150	0.579	0.168
	Lithuania	0.310	0.185	0.451	0.459	0.602	0.168
	Macao-China	0.189	0.090	0.292	0.222	0.598	0.168
	Malaysia	0.748	m	0.848	m	0.678	m
	Montenegro	0.336	0.185	0.419	0.459	0.591	0.168
	Peru	0.748	m	0.245	0.205	0.678	m
	Qatar	0.358	0.185	0.411	0.459	0.584	0.168
	Romania	0.308	0.185	0.287	0.207	0.604	0.168
	Russian Federation	0.186	0.084	0.284	0.148	0.620	0.168
	Serbia	0.329	0.185	0.424	0.459	0.594	0.168
	Shanghai-China	0.748	m	0.848	m	0.678	m
	Singapore	0.748	m	0.848	m	0.678	m
	Chinese Taipei	0.336	0.185	0.419	0.459	0.591	0.168
	Thailand	0.199	0.093	0.208	0.176	0.590	0.168
	Tunisia	0.191	0.091	0.288	0.221	0.595	0.168
	United Arab Emirates*	1.122	m	1.273	m	1.017	m
	Uruguay	0.205	0.092	0.274	0.220	0.589	0.168

Note: The link error is calculated empirically by adding a random error component from a normal distribution with mean equal to zero and standard deviation equal to those shown in Table A5.1 to each student's scores in PISA 2000, PISA 2003, PISA 2006 or PISA 2009. The linear and quadratic terms of a regression model are then calculated for each of 500 replications. The standard deviation in the observed coefficients is the result of the added error and is the reported link error.

* United Arab Emirates excluding Dubai.

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The annualised change in performance is calculated through an individual-level OLS regression of the form

$$PISA_i = \beta_0 + \beta_1 year_i + \varepsilon_i$$

where $PISA_i$ is student *i*'s mathematics, reading or science score, $year_i$ is the year student *i* took the PISA assessment and ε_i is an error term indicating student *i*'s difference from the group mean. Under this specification, the estimate for β_1 indicates the annualised rate of change. Just as a link error is added when drawing comparisons between two PISA assessments, the standard errors for β_1 also include a link error:

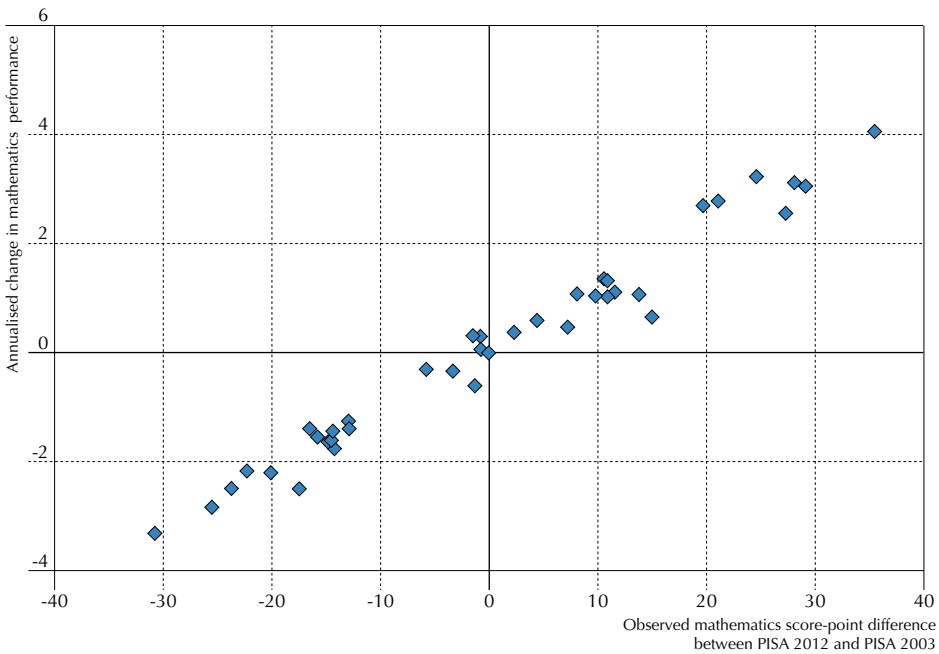
$$\sigma_{link}(\beta_1) = \sqrt{\sigma^2(\beta_1) + error^2_{annual}}$$

where $error_{annual}$ is the link error associated to the linear term in a regression model. It is presented in Table A5.3.

The annualised change is a more robust measure of a country's/economy's progress in education outcomes as it is based on information available from all assessments. It is thus less sensitive to abnormal measurements that may alter a country's/economy's PISA trends if results are compared only between two assessments. The annualised change is calculated as the best-fitting line throughout a country's/economy's participation in PISA. The year that individual students participated in PISA is regressed on their PISA scores, yielding the annualised change. The annualised change also takes into account the fact that, for some countries and economies, the period between PISA assessments is less than three years. This is the case for those countries and economies that participated in PISA 2000 or PISA 2009 as part of PISA+: they conducted the assessment in 2001, 2002 or 2010 instead of 2000 or 2009. Figure A5.1 compares the value of the annualised change in mathematics with the difference in mathematics performance observed in PISA 2012 and PISA 2003. Figures A5.2 and A5.3 do the same for reading and science: they compare the annualised change in performance with the difference between PISA 2012 and PISA 2000 and PISA 2006, respectively. In general, and especially in the comparison between science in PISA 2006 and PISA 2012, the annualised change provides a result similar to the difference in performance between two assessments. As more assessments are taken into account, the annualised change begins to differ from the observed trend, providing a more complete picture of a country's/economy's progress in PISA.

■ Figure A5.1 ■

Annualised change in mathematics performance since PISA 2003 and observed difference in performance between PISA 2012 and PISA 2003



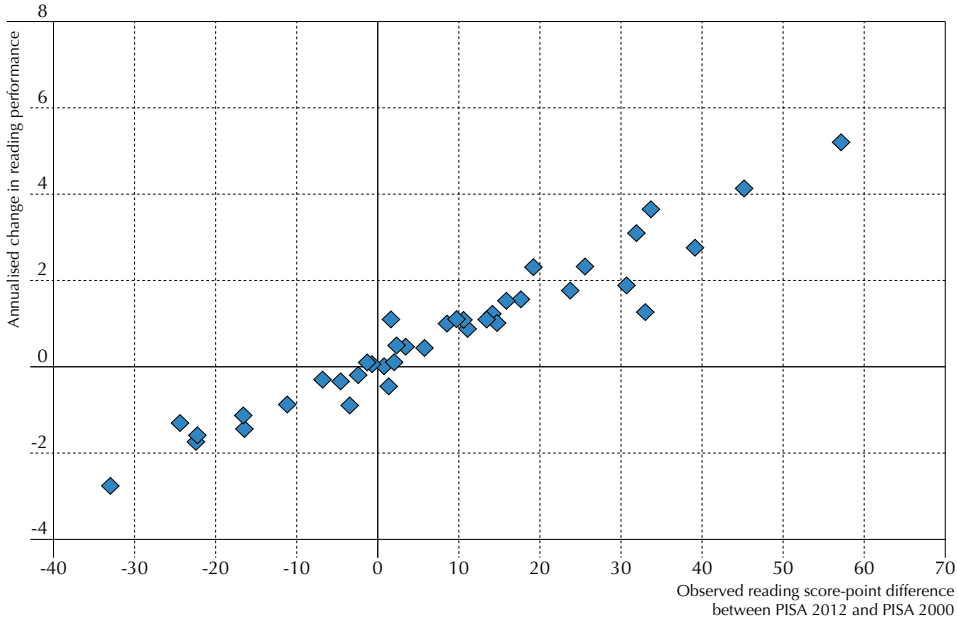
Notes: The annualised change is the average annual change in PISA score points from a country's/economy's earliest participation in PISA to PISA 2012. It is calculated taking into account all country's/economy's participation in PISA.

Source: OECD, PISA 2012 Database, Table I.2.3b.

StatLink http://dx.doi.org/10.1787/888932937054

■ Figure A5.2 ■

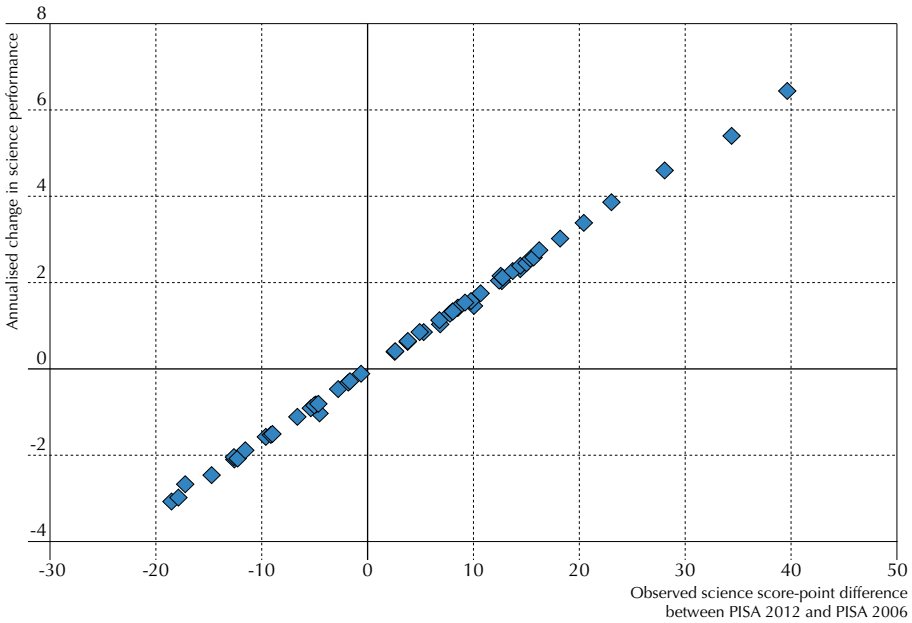
Annualised change in reading performance since PISA 2000 and observed difference in performance between PISA 2012 and PISA 2000



Notes: The annualised change is the average annual change in PISA score points from a country's/economy's earliest participation in PISA to PISA 2012. It is calculated taking into account all country's/economy's participation in PISA.
Source: OECD, PISA 2012 Database, Table I.4.3b.
StatLink http://dx.doi.org/10.1787/888932937054

■ Figure A5.3 ■

Annualised change in science performance since PISA 2006 and observed difference in performance between PISA 2012 and PISA 2006



Notes: The annualised change is the average annual change in PISA score points from a country's/economy's earliest participation in PISA to PISA 2012. It is calculated taking into account all country's/economy's participation in PISA.
Source: OECD, PISA 2012 Database, Table I.5.3b.
StatLink http://dx.doi.org/10.1787/888932937054

The annualised change assumes that progress in PISA is linear. An extension of the model that yields the annualised change is one that adds the curvature to the estimated annualised change by adding a quadratic term to the regression model (the curvilinear change):

$$PISA_i = \beta_0 + \beta_1 year_i + \beta_2 year_1^2 + \varepsilon_i$$

where $year_i^2$ is equal to the square of $year_i$. When *year* is scaled such that it is equal to zero in 2012, β_1 indicates the estimated rate of change in 2012 and β_2 the acceleration/deceleration of the trend. If β_2 is positive, it indicates that the observed trend is U-shaped, and rates of change in performance observed in years closer to 2012 are higher than those observed in earlier years. If β_2 is negative, the observed trend has an inverse-U-shape, and rates of change in performance observed in years closer to 2012 are lower than those observed in earlier years. Just as a link error is added when in the estimation of the standard errors for the annualised change, the standard errors for β_2 also include a link error:

$$\sigma_{link}(\beta_2) = \sqrt{\sigma^2(\beta_2) + error_{quadratic}^2}$$

where $error_{quadratic}$ is the link error associated to the quadratic term in a regression model. It is presented in Table A5.3.

The Annualised and curvilinear change assumes a specific type of change: linear or quadratic. This specification may not fit well when a country's/economy's progress in PISA is the result of a one-time change (as can result from targeted policies that shift the performance level but does not create a continuous trajectory of change). Because of the variable nature of a country's/economy's change in performance in PISA, changes in performance must be analysed through the different measures reported in this volume.

Adjusted trends

PISA maintains its technical standards over time. Although this means that trends can be calculated over comparable populations, in some countries departures in sampling methods were observed. Furthermore, the demographic characteristics and socio-economic background of 15-year-old populations can also be subject to change, for example because of migration, changes in economic conditions or changes in students' and parents' educational attainment over a particular period of time.

Because trend analyses illustrate the pace of progress of successive cohorts of students, in order to draw reliable conclusions from such results, it is important to examine the extent to which they are driven by changes in the demographic and socio-economic condition of students. Two sets of trend results were therefore developed: unadjusted and adjusted trends. Adjusted trends represent trends in performance estimated when controlling for any changes in the average demographic and socio-economic profile of different student cohorts. Linear regression can be used to adjust performance results for differences in student background characteristics. The procedure to adjust performance trends for a single country over time is similar to the adjustment procedure that is used in PISA to derive estimates on between country differences in performance when adjusting for differences in country specific socio-economic and demographic conditions.

PISA reports three sets of results based on adjustments for differences in socio-economic status and demographic characteristics: country-specific estimated mean performances when adjusting for differences across countries in socio-economic and demographic characteristics; country-specific estimated performance change between two assessments when adjusting for differences across country-specific cohorts in socio-economic and demographic characteristics; and country-specific estimated annualised performance change when adjusting for differences across country-specific cohorts in socio-economic and demographic characteristics. The adjusted mathematics, reading and science performance results reported in PISA Volume I use the 2012 PISA sample as a reference. Thus, the results from previous assessments were adjusted to be comparable to the 2012 sample and population. This was achieved by centring background characteristics on the 2012 average values for each country and then carrying out a regression with centred background characteristics to obtain adjusted trends. In other words, results for 2000, 2003, 2006 and 2009 were adjusted to match the 2012 data.

Table A5.4 provides means for background variables, with the following measures used for the adjustment: student gender and age, as well as indicators for students whose language spoken at home is different from the language of assessment and whether the student has an immigrant background. The last columns show changes in these characteristics. The results were also adjusted for changes in socio-economic status as measured by the *PISA index of economic, social and cultural status* (variable ESCS). As explained in Annex A1 and below, the ESCS index was re-estimated for 2000, 2003, 2006 and 2009 assessments to be comparable with 2012 results. Mean values, the standard deviation and changes in these statistics for the re-estimated ESCS index between 2012 and 2003 are reported in Table II.2.3b. These statistics could differ from those reported in previous reports, since the re-estimated values of the ESCS index that are comparable with 2012 results can differ slightly from those reported in previous assessments. In both tables, changes that are in bold print suggest that mean values on the respective measure changed between assessments. In this case, the difference between unadjusted and adjusted trends reflects this change, with adjusted trends accounting for it.

Unadjusted performance results are averaged across all students participating in PISA assessments. Thus, adjusted results should be also calculated over all participants in each country. That is not always possible, as in some cases, information on student background characteristics are missing due to non-response or invalid responses. Imputation of missing values was needed prior to the adjustments to sustain sample sizes and comparisons with unadjusted results. This was achieved using multiple imputation models that maintained the relationships between performance and background characteristics when imputing missing information (Rubin, 1987; Royston, 2004).

[Part 1/3]

Table A5.4 Descriptive statistics for variables used to adjust mathematics, reading and science scores to the PISA 2012 samples

		Students' age										Student is a girl									
		2000		2003		2006		2009		2012		2000		2003		2006		2009		2012	
		Mean	S.E.	Mean	S.E.	Mean	S.E.	Mean	S.E.	Mean	S.E.	%	S.E.	%	S.E.	%	S.E.	%	S.E.	%	S.E.
OECD	Australia	15.7	(0.01)	15.8	(0.00)	15.8	(0.00)	15.8	(0.00)	15.8	(0.00)	47.5	(2.18)	49.2	(1.31)	48.9	(1.39)	51.1	(1.30)	48.5	(0.59)
	Austria	15.8	(0.01)	15.8	(0.01)	15.8	(0.01)	m	m	15.8	(0.01)	48.8	(2.25)	49.9	(1.56)	49.1	(1.82)	m	m	50.1	(1.52)
	Belgium	15.7	(0.00)	15.9	(0.00)	15.9	(0.00)	15.8	(0.00)	15.8	(0.00)	47.9	(1.65)	47.9	(1.36)	47.6	(1.40)	48.9	(1.22)	49.8	(0.91)
	Canada	15.8	(0.00)	15.9	(0.00)	15.8	(0.00)	15.8	(0.00)	15.8	(0.00)	50.1	(0.52)	50.7	(0.63)	49.7	(0.62)	49.7	(0.47)	50.1	(0.43)
	Chile	15.8	(0.00)	m	m	15.8	(0.00)	15.8	(0.00)	15.8	(0.00)	53.0	(1.82)	m	m	46.0	(1.55)	49.0	(1.12)	51.6	(1.28)
	Czech Republic	15.7	(0.01)	15.9	(0.01)	15.9	(0.01)	15.8	(0.01)	15.7	(0.01)	51.7	(1.77)	49.3	(1.72)	43.4	(1.90)	46.8	(1.80)	48.7	(1.68)
	Denmark	15.7	(0.00)	15.7	(0.01)	15.7	(0.01)	15.7	(0.00)	15.8	(0.01)	49.7	(0.94)	50.9	(0.81)	50.3	(0.80)	50.5	(0.70)	49.7	(0.56)
	Estonia	m	m	m	m	15.8	(0.01)	15.8	(0.00)	15.8	(0.01)	m	m	m	m	48.8	(0.86)	48.2	(0.70)	50.5	(0.69)
	Finland	15.6	(0.00)	15.7	(0.00)	15.6	(0.00)	15.7	(0.00)	15.7	(0.00)	51.4	(0.78)	50.1	(0.72)	50.4	(0.83)	49.9	(0.51)	48.6	(0.47)
	France	15.8	(0.01)	15.9	(0.00)	15.7	(0.01)	15.9	(0.00)	15.9	(0.00)	51.3	(1.32)	52.6	(1.35)	51.5	(1.28)	51.3	(1.19)	51.4	(1.00)
	Germany	15.7	(0.01)	15.8	(0.00)	15.9	(0.00)	15.8	(0.01)	15.8	(0.01)	49.7	(1.47)	49.7	(1.04)	48.4	(0.86)	48.9	(0.97)	49.1	(0.75)
	Greece	15.7	(0.01)	15.7	(0.00)	15.7	(0.00)	15.7	(0.01)	15.7	(0.00)	49.8	(1.31)	51.7	(1.19)	49.7	(1.00)	50.9	(1.11)	50.5	(0.72)
	Hungary	15.7	(0.01)	15.7	(0.01)	15.7	(0.01)	15.7	(0.00)	15.7	(0.00)	49.6	(2.11)	47.3	(1.58)	47.9	(1.87)	49.6	(1.51)	51.8	(1.43)
	Iceland	15.6	(0.00)	15.7	(0.00)	15.7	(0.00)	15.7	(0.00)	15.7	(0.00)	50.4	(0.84)	48.4	(0.82)	49.6	(0.75)	50.3	(0.26)	49.4	(0.33)
	Ireland	15.7	(0.00)	15.7	(0.01)	15.7	(0.00)	15.7	(0.00)	15.7	(0.00)	50.4	(1.79)	49.6	(0.91)	50.6	(1.07)	49.4	(1.08)	49.2	(1.09)
	Israel	15.6	(0.01)	m	m	15.8	(0.01)	15.7	(0.00)	15.7	(0.00)	58.2	(2.67)	m	m	50.4	(1.40)	50.9	(0.93)	50.8	(0.81)
	Italy	15.7	(0.00)	15.7	(0.00)	15.7	(0.00)	15.7	(0.00)	15.8	(0.00)	49.3	(2.70)	51.9	(1.71)	50.4	(0.97)	48.6	(0.93)	48.2	(0.91)
	Japan	15.7	(0.00)	15.8	(0.00)	15.8	(0.00)	15.8	(0.00)	15.8	(0.00)	50.5	(2.35)	51.7	(2.27)	49.9	(2.39)	48.4	(1.77)	47.4	(1.48)
	Korea	15.7	(0.00)	15.8	(0.00)	15.8	(0.01)	15.7	(0.01)	15.7	(0.01)	44.1	(3.53)	40.5	(3.00)	49.3	(2.98)	47.3	(1.81)	46.6	(1.58)
	Luxembourg	m	m	15.8	(0.00)	15.9	(0.00)	15.8	(0.00)	15.8	(0.00)	m	m	50.8	(0.58)	49.4	(0.67)	49.3	(0.16)	49.2	(0.20)
	Mexico	15.7	(0.01)	15.8	(0.01)	15.7	(0.01)	15.7	(0.00)	15.7	(0.00)	50.0	(1.19)	51.8	(0.99)	51.9	(0.95)	50.6	(0.44)	51.0	(0.36)
	Netherlands	m	m	15.7	(0.01)	15.7	(0.00)	15.7	(0.00)	15.7	(0.01)	m	m	49.0	(1.19)	49.1	(0.92)	50.3	(0.70)	48.8	(0.67)
	New Zealand	15.7	(0.00)	15.8	(0.00)	15.8	(0.00)	15.8	(0.00)	15.8	(0.00)	49.7	(2.44)	50.0	(1.98)	51.6	(2.10)	49.0	(1.23)	48.9	(1.19)
	Norway	15.7	(0.00)	15.8	(0.00)	15.8	(0.01)	15.8	(0.00)	15.8	(0.01)	49.0	(0.88)	49.6	(0.82)	48.3	(0.73)	48.9	(0.48)	48.7	(0.51)
	Poland	15.7	(0.01)	15.7	(0.00)	15.7	(0.00)	15.7	(0.00)	15.7	(0.00)	49.1	(2.65)	50.1	(0.72)	50.3	(0.75)	50.0	(0.51)	51.2	(0.84)
	Portugal	15.6	(0.00)	15.9	(0.01)	15.7	(0.01)	15.7	(0.01)	15.7	(0.01)	52.0	(0.92)	52.4	(0.90)	51.7	(0.81)	51.1	(0.62)	49.4	(0.68)
	Slovak Republic	m	m	15.8	(0.01)	15.7	(0.01)	15.7	(0.01)	15.8	(0.01)	m	m	48.8	(1.71)	48.6	(1.71)	50.4	(1.57)	47.6	(1.56)
	Slovenia	m	m	m	m	15.7	(0.00)	15.7	(0.01)	15.7	(0.00)	m	m	m	m	50.2	(0.74)	49.0	(0.45)	48.2	(0.44)
	Spain	15.8	(0.00)	15.8	(0.00)	15.8	(0.00)	15.9	(0.00)	15.9	(0.00)	50.8	(1.34)	50.8	(1.09)	49.4	(0.71)	49.2	(0.57)	49.2	(0.43)
	Sweden	15.7	(0.00)	15.7	(0.00)	15.7	(0.00)	15.8	(0.01)	15.7	(0.00)	49.2	(0.86)	49.9	(0.90)	48.7	(0.76)	49.2	(0.53)	49.6	(0.57)
	Switzerland	15.7	(0.01)	15.8	(0.01)	15.8	(0.01)	15.8	(0.01)	15.9	(0.01)	49.8	(1.00)	48.3	(1.62)	48.4	(0.83)	49.2	(1.14)	49.9	(1.20)
	Turkey	m	m	15.9	(0.00)	15.9	(0.01)	15.8	(0.00)	15.8	(0.00)	m	m	45.0	(1.95)	45.3	(1.92)	48.4	(1.71)	49.5	(1.98)
	United Kingdom	m	m	m	m	15.7	(0.00)	15.7	(0.00)	15.7	(0.00)	m	m	m	m	50.5	(1.02)	50.9	(1.61)	51.0	(1.35)
	United States	15.7	(0.01)	15.8	(0.01)	15.8	(0.01)	15.8	(0.01)	15.8	(0.01)	51.6	(0.98)	49.6	(0.82)	49.4	(0.94)	48.7	(0.75)	49.0	(0.72)
Partners	Albania	15.7	(0.01)	m	m	m	m	15.8	(0.01)	15.8	(0.01)	51.0	(1.20)	m	m	m	m	48.7	(0.87)	48.3	(1.25)
	Argentina	15.8	(0.01)	m	m	15.7	(0.01)	15.7	(0.01)	15.7	(0.01)	56.4	(2.52)	m	m	52.9	(1.39)	53.7	(1.06)	51.4	(1.14)
	Brazil	15.7	(0.01)	15.8	(0.00)	15.8	(0.00)	15.9	(0.00)	15.9	(0.00)	54.0	(1.16)	53.6	(0.82)	53.8	(0.81)	53.1	(0.38)	52.2	(0.43)
	Bulgaria	15.6	(0.00)	m	m	15.7	(0.01)	15.8	(0.01)	15.8	(0.00)	48.5	(1.90)	m	m	48.2	(1.83)	48.1	(2.24)	48.2	(1.78)
	Colombia	m	m	m	m	15.8	(0.01)	15.9	(0.01)	15.9	(0.00)	m	m	m	m	53.9	(1.93)	52.4	(1.20)	52.9	(0.94)
	Costa Rica	m	m	m	m	m	m	15.8	(0.01)	15.8	(0.01)	m	m	m	m	m	m	53.0	(0.61)	53.1	(0.72)
	Croatia	m	m	m	m	15.7	(0.00)	15.7	(0.00)	15.7	(0.00)	m	m	m	m	50.0	(1.90)	47.0	(1.87)	49.0	(0.99)
	Dubai (UAE)	m	m	m	m	m	m	15.8	(0.00)	15.8	(0.00)	m	m	m	m	m	m	48.9	(0.14)	48.9	(0.25)
	Hong Kong-China	15.7	(0.00)	15.8	(0.01)	15.8	(0.01)	15.7	(0.00)	15.7	(0.00)	49.8	(2.12)	49.8	(2.36)	50.7	(1.92)	47.1	(1.76)	46.3	(1.84)
	Indonesia	15.7	(0.01)	15.7	(0.00)	15.8	(0.01)	15.8	(0.01)	15.9	(0.01)	51.1	(1.84)	50.4	(1.36)	48.7	(2.05)	50.5	(1.95)	49.2	(1.51)
	Jordan	m	m	m	m	15.9	(0.00)	15.9	(0.01)	15.9	(0.00)	m	m	m	m	50.2	(1.95)	49.6	(1.30)	50.6	(1.58)
	Kazakhstan	m	m	m	m	m	m	15.8	(0.01)	15.8	(0.01)	m	m	m	m	m	m	49.3	(0.72)	50.2	(0.97)
	Latvia	15.7	(0.01)	15.9	(0.01)	15.8	(0.01)	15.8	(0.01)	15.8	(0.01)	51.3	(1.56)	52.0	(1.22)	51.4	(0.69)	50.7	(0.87)	49.6	(0.89)
	Liechtenstein	15.7	(0.02)	15.8	(0.01)	15.8	(0.01)	15.8	(0.02)	15.8	(0.01)	49.7	(2.87)	48.7	(2.77)	53.8	(2.31)	47.0	(1.21)	46.8	(1.31)
	Lithuania	m	m	m	m	15.8	(0.01)	15.8	(0.01)	15.8	(0.00)	m	m	m	m	49.1	(0.71)	49.3	(0.50)	49.6	(0.61)
	Macao-China	m	m	15.8	(0.01)	15.8	(0.00)	15.8	(0.00)	15.8	(0.00)	m	m	51.4	(1.53)	49.4	(0.81)	49.4	(0.09)	48.7	(0.24)
	Malaysia	m	m	m	m	m	m	15.8	(0.00)	15.8	(0.01)	m	m	m	m	m	m	50.9	(0.81)	51.6	(1.09)
	Montenegro	m	m	m	m	15.7	(0.00)	15.8	(0.00)	15.8	(0.00)	m	m	m	m	48.4	(0.57)	48.8	(0.26)	50.0	(0.23)
	Peru	15.7	(0.01)	m	m	m	m	15.8	(0.00)	15.8	(0.00)	49.9	(2.23)	m	m	m	m	49.5	(1.21)	51.4	(1.59)
	Qatar	m	m	m	m	15.7	(0.00)	15.7	(0.00)	15.8	(0.00)	m	m	m	m	49.4	(0.12)	49.1	(0.11)	48.4	(0.13)
	Romania	14.7	(0.01)	m	m	15.7	(0.01)	15.7	(0.01)	15.7	(0.00)	52.7	(1.12)	m	m	50.2	(1.77)	50.9	(1.41)	51.0	(1.26)
	Russian Federation	15.7	(0.00)	15.8	(0.01)	15.8	(0.01)	15.8	(0.01)	15.8	(0.01)	50.1	(0.89)	50.3	(1.32)	52.1	(1.00)	50.4	(0.72)	50.0	(0.82)
	Serbia	m	m	m	m	15.8	(0.01)	15.8	(0.01)	15.9	(0.01)	m	m	m	m	49.2	(1.48)	49.8	(1.21)	50.2	(1.07)
	Shanghai-China	m	m	m	m	m	m	15.8	(0.00)	15.8	(0.01)	m	m	m	m	m	m	50.5	(0.94)	51.3	(0.93)
	Singapore	m	m	m	m	m	m	15.7	(0.00)	15.8	(0.00)	m	m	m	m	m	m	49.2	(0.17)	49.0	(0.40)
	Chinese Taipei	m	m	m	m	15.7	(0.01)	15.7	(0.01)	15.7	(0.01)	m	m	m	m	47.6	(1.45)	49.5	(1.75)	50.9	(1.82)
	Thailand	15.8	(0.01)	15.7	(0.01)	15.7	(0.01)	15.7	(0.01)	15.7	(0.01)	58.8	(2.04)	54.9	(1.31)	57.4	(1.45)	56.7	(1.54)	56.0	(1.24)
	Tunisia	m	m	15.9	(0.00)	15.9	(0.00)	15.9	(0.00)	15.9	(0.00)	m	m	50.7	(0.76)	52.2	(0.92)	52.4	(0.48)	53.4	(0.61)
	United Arab Emirates*	m	m	m	m	m	m	15.8	(0.01)	15.9	(0.00)	m	m	m	m	m	m	50.4	(1.17)	51.8	(2.71)
	Uruguay	m	m	15.8	(0.01)	15.9	(0.00)	15.9	(0.00)	15.8	(0.00)	m	m	51.2	(1.18)	51.2	(0.95)	53.0	(0.69)	53.1	(0.92)

* United Arab Emirates excluding Dubai.

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[Part 2/3]

Table A5.4 Descriptive statistics for variables used to adjust mathematics, reading and science scores to the PISA 2012 samples

		Students' PISA index of economic, social and cultural status										Student has an immigrant background									
		2000		2003		2006		2009		2012		2000		2003		2006		2009		2012	
		Mean	S.E.	Mean	S.E.	Mean	S.E.	Mean	S.E.	Mean	S.E.	%	S.E.	%	S.E.	%	S.E.	%	S.E.	%	S.E.
OECD	Australia	-0.02	(0.03)	0.04	(0.02)	0.22	(0.01)	0.27	(0.01)	0.25	(0.01)	11.9	(1.20)	22.7	(1.13)	21.9	(1.16)	23.2	(1.15)	22.7	(0.74)
	Austria	-0.29	(0.02)	-0.26	(0.03)	0.03	(0.02)	m	m	0.08	(0.02)	6.9	(0.69)	13.3	(0.99)	13.2	(1.22)	m	m	16.5	(1.06)
	Belgium	-0.21	(0.02)	-0.03	(0.02)	0.07	(0.02)	0.16	(0.02)	0.15	(0.02)	3.5	(0.40)	11.8	(0.91)	13.3	(0.96)	14.8	(1.11)	15.3	(0.87)
	Canada	0.18	(0.01)	0.21	(0.02)	0.30	(0.02)	0.44	(0.01)	0.41	(0.02)	9.8	(0.61)	20.1	(1.14)	21.1	(1.18)	24.4	(1.33)	29.6	(1.33)
	Chile	-1.14	(0.04)	m	m	-0.98	(0.06)	-0.57	(0.03)	-0.58	(0.04)	0.2	(0.08)	m	m	0.6	(0.12)	0.5	(0.10)	0.9	(0.15)
	Czech Republic	-0.46	(0.02)	-0.05	(0.02)	-0.11	(0.02)	-0.07	(0.01)	-0.07	(0.02)	0.5	(0.11)	1.3	(0.18)	1.9	(0.23)	2.3	(0.24)	3.3	(0.37)
	Denmark	0.18	(0.02)	0.08	(0.03)	0.45	(0.02)	0.45	(0.02)	0.43	(0.02)	3.9	(0.43)	6.5	(0.78)	7.6	(0.81)	8.6	(0.39)	9.2	(0.59)
	Estonia	m	m	m	m	-0.13	(0.02)	0.10	(0.02)	0.11	(0.01)	m	m	m	m	11.6	(0.59)	8.0	(0.62)	8.1	(0.54)
	Finland	-0.18	(0.02)	0.06	(0.02)	0.19	(0.02)	0.39	(0.02)	0.36	(0.02)	1.0	(0.18)	1.9	(0.23)	1.5	(0.28)	2.6	(0.33)	3.4	(0.18)
	France	-0.42	(0.02)	-0.32	(0.03)	-0.28	(0.03)	-0.14	(0.03)	-0.04	(0.02)	2.2	(0.27)	14.3	(1.33)	13.0	(1.02)	13.1	(1.36)	15.0	(1.12)
	Germany	-0.01	(0.02)	0.01	(0.03)	0.19	(0.03)	0.20	(0.02)	0.19	(0.02)	10.2	(0.59)	15.4	(1.10)	14.2	(0.98)	17.6	(1.01)	13.4	(0.80)
	Greece	-0.36	(0.03)	-0.30	(0.05)	-0.22	(0.03)	-0.03	(0.03)	-0.06	(0.03)	4.4	(0.90)	7.4	(0.65)	7.6	(0.75)	9.0	(0.80)	10.6	(0.84)
	Hungary	-0.49	(0.03)	-0.31	(0.02)	-0.26	(0.03)	-0.16	(0.03)	-0.25	(0.03)	1.6	(0.20)	2.3	(0.23)	1.7	(0.25)	2.1	(0.25)	1.7	(0.24)
	Iceland	0.24	(0.02)	0.55	(0.02)	0.61	(0.01)	0.72	(0.01)	0.78	(0.01)	0.6	(0.15)	1.0	(0.19)	1.8	(0.24)	2.4	(0.25)	3.5	(0.33)
	Ireland	-0.33	(0.03)	-0.26	(0.03)	-0.06	(0.03)	0.08	(0.02)	0.13	(0.02)	1.4	(0.26)	3.5	(0.31)	5.6	(0.47)	8.3	(0.61)	10.2	(0.71)
	Israel	-0.17	(0.05)	m	m	0.11	(0.02)	0.14	(0.02)	0.17	(0.03)	8.8	(1.09)	m	m	23.0	(1.24)	19.7	(1.09)	18.3	(1.15)
	Italy	-0.33	(0.02)	-0.29	(0.03)	-0.19	(0.02)	-0.03	(0.01)	-0.05	(0.01)	0.8	(0.20)	2.1	(0.26)	3.8	(0.29)	5.5	(0.27)	7.5	(0.34)
	Japan	0.00	c	-0.42	(0.02)	-0.16	(0.02)	-0.07	(0.01)	-0.07	(0.02)	0.1	(0.05)	0.1	(0.05)	0.4	(0.10)	0.3	(0.07)	0.3	(0.07)
	Korea	-0.57	(0.03)	-0.36	(0.03)	-0.16	(0.02)	-0.01	(0.03)	0.01	(0.03)	0.0	c	0.0	(0.02)	0.0	(0.02)	0.0	(0.02)	0.0	(0.02)
	Luxembourg	m	m	-0.09	(0.01)	0.00	(0.01)	0.17	(0.01)	0.07	(0.01)	m	m	33.3	(0.61)	36.1	(0.63)	40.2	(0.65)	46.1	(0.66)
	Mexico	-1.23	(0.05)	-1.32	(0.05)	-1.05	(0.04)	-0.99	(0.03)	-1.11	(0.02)	2.4	(0.33)	2.3	(0.25)	2.4	(0.30)	1.9	(0.15)	1.3	(0.12)
	Netherlands	m	m	-0.08	(0.03)	0.16	(0.02)	0.13	(0.03)	0.23	(0.02)	m	m	11.0	(1.39)	11.3	(1.09)	12.1	(1.39)	10.9	(1.00)
	New Zealand	-0.07	(0.02)	-0.13	(0.02)	0.11	(0.02)	0.15	(0.01)	0.04	(0.02)	13.6	(0.85)	19.8	(1.14)	21.3	(0.99)	24.7	(1.05)	26.4	(1.54)
	Norway	0.21	(0.02)	0.19	(0.02)	0.35	(0.02)	0.58	(0.02)	0.46	(0.02)	3.1	(0.31)	5.6	(0.73)	6.1	(0.71)	6.8	(0.55)	9.5	(0.86)
	Poland	-0.62	(0.03)	-0.41	(0.02)	-0.57	(0.02)	-0.30	(0.02)	-0.21	(0.03)	0.2	(0.11)	0.0	(0.03)	0.2	(0.06)	0.0	(0.03)	0.2	(0.06)
	Portugal	-0.81	(0.04)	-0.91	(0.05)	-0.80	(0.04)	-0.45	(0.04)	-0.48	(0.05)	1.4	(0.19)	5.0	(1.43)	5.9	(0.75)	5.5	(0.46)	6.9	(0.64)
	Slovak Republic	m	m	-0.25	(0.03)	-0.18	(0.02)	-0.10	(0.02)	-0.18	(0.03)	m	m	0.9	(0.19)	0.5	(0.09)	0.5	(0.13)	0.7	(0.16)
	Slovenia	m	m	m	m	-0.22	(0.01)	0.06	(0.01)	0.07	(0.01)	m	m	m	m	10.3	(0.47)	7.8	(0.41)	8.7	(0.45)
	Spain	-0.74	(0.05)	-0.51	(0.04)	-0.46	(0.03)	-0.21	(0.03)	-0.19	(0.03)	1.4	(0.33)	3.4	(0.37)	6.9	(0.70)	9.5	(0.51)	9.9	(0.60)
	Sweden	0.15	(0.02)	0.08	(0.03)	0.26	(0.02)	0.39	(0.02)	0.28	(0.02)	6.0	(0.61)	11.5	(0.87)	10.8	(0.93)	11.7	(1.18)	14.9	(0.85)
	Switzerland	-0.17	(0.03)	-0.23	(0.03)	0.02	(0.02)	0.13	(0.02)	0.17	(0.02)	11.5	(0.71)	20.0	(0.91)	22.4	(0.73)	23.5	(0.90)	24.3	(0.89)
	Turkey	m	m	-1.15	(0.06)	-1.32	(0.04)	-1.14	(0.04)	-1.46	(0.04)	m	m	1.0	(0.24)	1.5	(0.45)	0.5	(0.14)	0.9	(0.23)
	United Kingdom	m	m	m	m	0.13	(0.01)	0.25	(0.02)	0.27	(0.02)	m	m	m	m	8.6	(0.90)	10.6	(0.97)	13.0	(1.08)
	United States	0.07	(0.07)	0.05	(0.03)	0.20	(0.04)	0.24	(0.04)	0.17	(0.04)	6.1	(0.90)	14.4	(0.95)	15.2	(1.23)	19.5	(1.34)	21.6	(1.98)
Partners	Albania	-0.92	(0.02)	m	m	m	m	-0.85	(0.03)	m	m	0.4	(0.13)	m	m	m	m	0.6	(0.18)	0.3	(0.08)
	Argentina	-1.02	(0.08)	m	m	-0.83	(0.06)	-0.68	(0.05)	-0.72	(0.04)	0.4	(0.12)	m	m	2.7	(0.32)	3.6	(0.52)	3.9	(0.44)
	Brazil	-1.58	(0.05)	-1.56	(0.05)	-1.41	(0.03)	-1.24	(0.03)	-1.17	(0.02)	0.1	(0.06)	0.8	(0.22)	2.4	(0.25)	0.8	(0.14)	0.7	(0.11)
	Bulgaria	-0.43	(0.04)	m	m	-0.47	(0.05)	-0.26	(0.04)	-0.28	(0.04)	0.3	(0.11)	m	m	0.2	(0.07)	0.5	(0.13)	0.5	(0.17)
	Colombia	m	m	m	m	-1.31	(0.05)	-1.23	(0.04)	-1.26	(0.04)	m	m	m	m	0.4	(0.12)	0.3	(0.08)	0.3	(0.07)
	Costa Rica	m	m	m	m	m	m	-0.99	(0.04)	-0.98	(0.04)	m	m	m	m	m	m	6.0	(0.60)	5.5	(0.72)
	Croatia	m	m	m	m	-0.43	(0.01)	-0.25	(0.02)	-0.34	(0.02)	m	m	m	m	12.0	(0.71)	10.7	(0.61)	12.1	(0.75)
	Dubai (UAE)	m	m	m	m	m	m	0.47	(0.01)	0.50	(0.01)	m	m	m	m	m	m	71.4	(0.42)	68.7	(0.34)
	Hong Kong-China	-1.25	(0.03)	-1.27	(0.04)	-1.03	(0.03)	-0.95	(0.03)	-0.79	(0.05)	17.7	(0.85)	43.3	(1.41)	43.8	(1.37)	39.4	(1.46)	34.7	(1.54)
	Indonesia	-1.88	(0.04)	-1.86	(0.04)	-1.90	(0.05)	-1.82	(0.05)	-1.80	(0.05)	0.2	(0.07)	0.3	(0.10)	0.2	(0.11)	0.3	(0.11)	0.2	(0.06)
	Jordan	m	m	m	m	-0.52	(0.03)	-0.42	(0.03)	-0.42	(0.02)	m	m	m	m	16.8	(0.89)	13.8	(0.86)	13.4	(0.73)
	Kazakhstan	m	m	m	m	m	m	-0.40	(0.02)	-0.32	(0.02)	m	m	m	m	m	m	11.6	(1.12)	16.1	(1.65)
	Latvia	-0.61	(0.03)	-0.34	(0.03)	-0.44	(0.02)	-0.28	(0.03)	-0.26	(0.03)	22.0	(2.79)	9.4	(0.94)	7.1	(0.63)	4.5	(0.51)	4.7	(0.54)
	Liechtenstein	-0.45	(0.05)	-0.31	(0.04)	0.00	(0.05)	0.02	(0.05)	0.30	(0.05)	10.1	(1.63)	17.1	(1.98)	36.8	(2.70)	30.3	(2.49)	33.6	(2.82)
	Lithuania	m	m	m	m	-0.26	(0.02)	-0.22	(0.02)	-0.13	(0.02)	m	m	m	m	2.1	(0.38)	1.7	(0.27)	1.7	(0.31)
	Macao-China	m	m	-1.60	(0.03)	-1.23	(0.02)	-1.02	(0.01)	-0.89	(0.01)	m	m	76.1	(1.41)	73.6	(0.64)	70.4	(0.62)	65.1	(0.63)
	Malaysia	m	m	m	m	m	m	-0.56	(0.03)	-0.72	(0.03)	m	m	m	m	m	m	1.3	(0.25)	1.7	(0.27)
	Montenegro	m	m	m	m	-0.40	(0.01)	-0.37	(0.02)	-0.25	(0.01)	m	m	m	m	7.2	(0.46)	6.6	(0.42)	5.8	(0.42)
	Peru	-1.37	(0.04)	m	m	m	m	-1.20	(0.05)	-1.23	(0.05)	0.1	(0.05)	m	m	m	m	0.4	(0.08)	0.5	(0.10)
	Qatar	m	m	m	m	0.24	(0.01)	0.47	(0.01)	0.44	(0.01)	m	m	m	m	40.5	(0.50)	46.4	(0.43)	51.9	(0.39)
	Romania	-1.05	(0.04)	m	m	-0.69	(0.03)	-0.48	(0.03)	-0.47	(0.04)	0.1	(0.05)	m	m	0.1	(0.03)	0.3	(0.08)	0.2	(0.06)
	Russian Federation	-0.82	(0.03)	-0.61	(0.03)	-0.63	(0.03)	-0.27	(0.02)	-0.11	(0.02)	2.7	(0.39)	13.5	(0.71)	8.7	(0.54)	12.1	(0.75)	10.9	(0.80)
	Serbia	m	m	m	m	-0.46	(0.02)	-0.31	(0.02)	-0.30	(0.02)	m	m	m	m	9.0	(0.50)	9.5	(0.56)	8.5	(0.76)
	Shanghai-China	m	m	m	m	m	m	-0.46	(0.03)	-0.36	(0.04)	m	m	m	m	m	m	0.5	(0.11)	0.9	(0.18)
	Singapore	m	m	m	m	m	m	-0.29	(0.01)	-0.26	(0.01)	m	m	m	m	m	m	14.4	(0.66)	18.3	(0.85)
	Chinese Taipei	m	m	m	m	-0.51	(0.02)	-0.36	(0.02)	-0.40	(0.02)	m	m	m	m	0.6	(0.11)	0.4	(0.11)	0.5	(0.11)
	Thailand	-2.04	(0.04)	-1.86	(0.04)	-1.82	(0.03)	-1.49	(0.04)	-1.35	(0.04)	0.0	(0.03)	0.1	(0.07)	0.3	(0.13)	0.0	c	0.7	(0.44)
	Tunisia	m	m	-1.69	(0.04)	-1.30	(0.06)	-1.42	(0.05)	-1.19	(0.05)	m	m	0.3	(0.08)	0.8	(0.14)	0.3	(0.10)	0.4	(0.10)
	United Arab Emirates*	m	m	m	m	m	m	0.09	(0.02)	0.26	(0.02)	m	m	m	m	m	m	42.9	(1.54)	49.8	(1.86)
	Uruguay	m	m	-0.76	(0.04)	-0.79	(0.03)	-0.88	(0.02)	-0.88	(0.03)	m	m	0.8	(0.17)	0.4	(0.07)	0.6	(0.12)	0.5	(0.11)

* United Arab Emirates excluding Dubai.

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[Part 3/3]

Table A5.4 Descriptive statistics for variables used to adjust mathematics, reading and science scores to the PISA 2012 samples

		Student speaks a language at home that is different than the language of assessment									
		2000		2003		2006		2009		2012	
		%	S.E.	%	S.E.	%	S.E.	%	S.E.	%	S.E.
OECD	Australia	0.2	(0.06)	8.9	(0.66)	8.1	(0.68)	9.2	(0.72)	9.8	(0.51)
	Austria	0.0	c	9.0	(0.74)	10.0	(1.13)	m	m	11.4	(0.78)
	Belgium	19.0	(1.12)	4.8	(0.38)	18.0	(0.79)	21.6	(1.14)	21.6	(0.86)
	Canada	2.3	(0.15)	11.2	(0.69)	12.9	(0.77)	14.2	(0.83)	17.3	(0.91)
	Chile	0.3	(0.10)	m	m	0.2	(0.06)	0.5	(0.10)	0.6	(0.13)
	Czech Republic	0.0	c	0.9	(0.19)	1.6	(0.21)	1.3	(0.17)	2.9	(0.37)
	Denmark	0.0	c	3.9	(0.48)	4.5	(0.52)	4.5	(0.27)	4.6	(0.28)
	Estonia	m	m	m	m	4.1	(0.75)	2.7	(0.40)	5.5	(0.52)
	Finland	4.6	(0.22)	1.8	(0.21)	2.3	(0.45)	3.7	(0.32)	4.5	(0.22)
	France	1.1	(0.20)	6.1	(0.72)	7.0	(0.58)	7.0	(0.62)	8.0	(0.69)
	Germany	0.0	c	7.7	(0.57)	9.0	(0.74)	10.5	(0.76)	7.4	(0.63)
	Greece	0.0	c	3.2	(0.39)	3.9	(0.53)	4.8	(0.64)	5.1	(0.58)
	Hungary	0.0	c	0.6	(0.12)	0.8	(0.16)	1.0	(0.34)	1.0	(0.16)
	Iceland	0.0	c	1.6	(0.22)	2.2	(0.26)	3.1	(0.30)	3.9	(0.33)
	Ireland	1.0	(0.47)	0.8	(0.18)	4.1	(0.81)	5.8	(0.87)	4.9	(0.51)
	Israel	1.7	(0.37)	m	m	12.8	(1.12)	11.8	(1.05)	11.2	(0.91)
	Italy	17.4	(1.14)	1.6	(0.23)	14.6	(0.54)	14.3	(0.42)	14.3	(0.39)
	Japan	0.0	c	0.2	(0.07)	0.3	(0.10)	0.2	(0.06)	0.4	(0.08)
	Korea	0.0	c	0.1	(0.05)	0.1	(0.04)	0.1	(0.04)	0.1	(0.03)
	Luxembourg	m	m	25.0	(0.59)	90.4	(0.45)	88.9	(0.44)	85.5	(0.41)
	Mexico	1.5	(0.46)	1.1	(0.32)	3.4	(0.99)	2.8	(0.30)	3.2	(0.31)
	Netherlands	m	m	4.6	(0.62)	5.9	(0.69)	6.4	(0.81)	6.4	(0.54)
	New Zealand	0.8	(0.16)	9.0	(0.70)	9.0	(0.58)	14.5	(0.68)	16.1	(1.08)
	Norway	1.0	(0.22)	4.5	(0.53)	5.7	(0.50)	7.3	(0.51)	7.6	(0.63)
	Poland	0.5	(0.15)	0.2	(0.07)	0.4	(0.17)	0.6	(0.13)	0.8	(0.26)
	Portugal	0.0	c	1.4	(0.21)	2.3	(0.37)	1.6	(0.17)	2.6	(0.27)
	Slovak Republic	m	m	1.4	(0.33)	15.1	(1.38)	5.4	(0.77)	7.4	(0.88)
	Slovenia	m	m	m	m	6.1	(0.36)	5.2	(0.34)	5.9	(0.42)
	Spain	13.6	(1.45)	1.7	(0.28)	16.1	(0.86)	18.1	(1.04)	18.6	(1.11)
	Sweden	0.8	(0.17)	6.9	(0.67)	8.2	(0.89)	8.1	(0.86)	10.4	(0.69)
	Switzerland	6.1	(0.50)	9.5	(0.70)	15.7	(0.64)	15.5	(0.72)	16.5	(0.82)
	Turkey	m	m	1.2	(0.57)	2.4	(0.39)	4.0	(0.56)	6.3	(0.84)
	United Kingdom	m	m	m	m	4.8	(0.81)	6.2	(0.59)	7.0	(0.67)
	United States	0.0	c	9.0	(0.69)	10.7	(1.03)	13.1	(1.00)	14.4	(1.30)
Partners	Albania	0.7	(0.17)	m	m	m	m	1.0	(0.20)	2.6	(0.40)
	Argentina	0.4	(0.20)	m	m	0.9	(0.35)	1.4	(0.20)	1.6	(0.24)
	Brazil	0.0	c	0.5	(0.12)	0.3	(0.09)	0.7	(0.09)	1.1	(0.13)
	Bulgaria	1.2	(0.29)	m	m	10.5	(1.26)	10.9	(1.74)	10.7	(1.16)
	Colombia	m	m	m	m	0.5	(0.17)	0.4	(0.09)	0.7	(0.19)
	Costa Rica	m	m	m	m	m	m	1.5	(0.29)	1.2	(0.21)
	Croatia	m	m	m	m	1.4	(0.44)	1.7	(0.44)	1.3	(0.27)
	Dubai (UAE)	m	m	m	m	m	m	50.1	(0.65)	50.2	(0.73)
	Hong Kong-China	4.2	(0.73)	4.5	(0.39)	7.1	(0.89)	7.2	(1.08)	6.8	(0.88)
	Indonesia	67.4	(2.50)	2.1	(0.28)	65.8	(3.40)	64.4	(2.12)	58.9	(2.35)
	Jordan	m	m	m	m	2.9	(0.29)	3.2	(0.31)	4.7	(0.32)
	Kazakhstan	m	m	m	m	m	m	10.2	(0.78)	11.1	(0.92)
	Latvia	6.9	(0.94)	0.5	(0.12)	6.0	(0.51)	9.4	(1.30)	10.5	(1.40)
	Liechtenstein	7.9	(1.58)	18.4	(2.25)	12.2	(1.58)	15.0	(2.24)	11.7	(1.82)
	Lithuania	m	m	m	m	3.3	(0.89)	4.3	(0.83)	3.5	(0.51)
	Macao-China	m	m	4.6	(0.72)	99.3	(0.07)	11.0	(0.16)	13.6	(0.19)
	Malaysia	m	m	m	m	m	m	29.9	(2.23)	42.3	(2.46)
	Montenegro	m	m	m	m	43.6	(0.63)	1.7	(0.24)	1.0	(0.14)
	Peru	5.3	(1.22)	m	m	m	m	5.3	(0.86)	6.4	(0.89)
	Qatar	m	m	m	m	25.4	(0.30)	38.6	(0.31)	39.2	(0.30)
	Romania	1.8	(0.44)	m	m	2.9	(0.77)	3.2	(0.57)	1.7	(0.38)
	Russian Federation	0.0	c	5.4	(1.26)	9.5	(2.02)	9.6	(1.54)	8.6	(1.74)
	Serbia	m	m	m	m	1.3	(0.15)	1.8	(0.29)	4.2	(0.62)
	Shanghai-China	m	m	m	m	m	m	1.5	(0.24)	1.4	(0.18)
	Singapore	m	m	m	m	m	m	59.2	(0.80)	54.4	(0.87)
	Chinese Taipei	m	m	m	m	23.8	(1.40)	21.8	(1.24)	16.5	(1.07)
	Thailand	44.9	(2.34)	3.0	(1.04)	51.3	(1.87)	48.6	(1.65)	44.6	(1.68)
	Tunisia	m	m	0.4	(0.09)	4.7	(0.46)	0.1	(0.05)	1.1	(0.18)
	United Arab Emirates*	m	m	m	m	m	m	25.1	(1.25)	27.4	(1.18)
	Uruguay	m	m	1.9	(0.40)	1.4	(0.27)	2.3	(0.23)	2.1	(0.35)

* United Arab Emirates excluding Dubai.

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The imputation model was carried out once for each plausible value and included all student background characteristics that were listed in the previous paragraph. After the imputation, all calculations were carried out five times, once for each imputed dataset containing one of five plausible values of the performance measures. Final results were obtained by averaging regression outcomes obtained from each imputed dataset and by accounting for imputation error using so-called Rubin's combination rules (Rubin, 1987). The results after imputation differ negligibly from those without the imputation given that for most countries and assessments the number of missing observations was relatively low.

Comparing items and non-performance scales across PISA cycles

To gather information about students' and schools' characteristics, PISA asks both students and schools to complete a background questionnaire. In PISA 2003 and PISA 2012 several questions were left untouched, allowing for a comparison of responses to these questions over time. In this report, only questions that retained the same wording were used for trends analyses. Questions with subtle word changes or questions with major word changes were not compared across time because it is impossible to discern whether observed changes in the response are due to changes in the construct they are measuring or to changes in the way the construct is being measured.

Also, as described in Annex A1, questionnaire items in PISA are used to construct indices. Whenever the questions used in the construction of indices remains intact in PISA 2003 and PISA 2012, the corresponding indices are compared. Two types of indices are used in PISA: simple indices and scale indices.

Simple indices recode a set of responses to questionnaire items. For trends analyses, the values observed in PISA 2003 are compared directly to PISA 2012, just as simple responses to questionnaire items are. This is the case of indices like student-teacher ratio and ability grouping in mathematics.

Scale indices, on the other hand, imply WLE estimates which require rescaling in order to be comparable across PISA cycles. Scale indices, like the *PISA index of economic, social and cultural status*, the *index of sense of belonging*, the *index of attitudes towards school*, the *index of intrinsic motivation to learn mathematics*, the *index of instrumental motivation to learn mathematics*, the *index of mathematics self-efficacy*, the *index of mathematics self-concept*, the *index of anxiety towards mathematics*, the *index of teacher shortage*, the *index of quality of physical infrastructure*, the *index of quality of educational resources*, the *index of disciplinary climate*, the *index of student-teacher relations*, the *index of teacher morale*, the *index of student-related factors affecting school climate*, and the *index of teacher-related factors affecting school climate*, were scaled in PISA 2012 to have an OECD average of 0 and a standard deviation of 1, on average across OECD countries. In PISA 2003 these same scales were scaled to have an OECD average of 0 and a standard deviation of 1. Because they are on different scales, values reported in *Learning for Tomorrow's World: First Results from PISA 2003* (OECD, 2004) cannot be compared with those reported in this volume. To make these scale indices comparable, values for 2003 have been rescaled to the 2012 scale, using the PISA 2012 parameter estimates.

To evaluate change in these items and scales, analyses report the change in the estimate between two assessments, usually PISA 2003 and PISA 2012. Comparisons between two assessments (e.g. a country's/economy's change in the *index of anxiety towards mathematics* between PISA 2003 and PISA 2012 or the change in this index for a subgroup) is calculated as:

$$\Delta_{2012,t} = PISA_{2012} - PISA_{t}$$

where $\Delta_{2012,t}$ is the difference in the index between PISA 2012 and a previous assessment, $PISA_{2012}$ is the index value observed in PISA 2012, and $PISA_t$ is the index value observed in a previous assessment (2000, 2003, 2006 or 2009). The standard error of the change in performance $\sigma(\Delta_{2012\text{-}t})$ is:

$$\sigma(\Delta_{2012-t}) = \sqrt{\sigma_{2012}^2 + \sigma_t^2}$$

where σ_{2012} is the standard error observed for $PISA_{2012}$ and σ_t is the standard error observed for $PISA_t$. These comparisons are based on an identical set of items; there is no uncertainty related to the choice of items for equating purposes, so no link error is needed.

Although only scale indices that use the same items in PISA 2003 and PISA 2012 are valid for trend comparisons, this does not imply that PISA 2012 indices that include exactly the same items as 2003 as well as new questionnaire items cannot be compared with PISA 2003 indices that included a smaller pool of items. In such cases, for example the *index of sense of belonging* trend analyses were conducted by treating as missing in PISA 2003 items that were asked in the context of PISA 2012 but not in the PISA 2003 student questionnaire. This means that while the full set of information was used to scale the sense of belonging index in 2012, the PISA 2003 sense of belonging index was scaled under the assumption that if the 2012 items that were missing in 2003 had been asked in 2003, the overall index and index variation would have remained the same as those that were observed on common 2003 items. This is a tenable assumption inasmuch as in both PISA 2003 and PISA 2012 the questionnaire items used to construct the scale hold as an underlying factor in the construction of the scale.

OECD average

Throughout this report, the OECD average is used as a benchmark. It is calculated as the average across OECD countries, weighting each country equally. Some OECD countries did not participate in certain assessments, other OECD countries do not have comparable results for some assessments, others did not include certain questions in their questionnaires or changed them substantially from assessment to assessment. For this reason in trends tables and figures, the OECD average is reported as assessment-specific, that is, it includes only those countries for which there is comparable information in that particular assessment. This way, the 2003 OECD average includes only those OECD countries that have comparable information from the 2003 assessment, even if the results it refers to the PISA 2012 assessment and more countries have comparable information. This restriction allows for valid comparisons of the OECD average over time.

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ANNEX A6
DEVELOPMENT OF THE PISA ASSESSMENT INSTRUMENTS

Annex A6 is available on line only.

It can be found at: *www.pisa.oecd.org*

ANNEX A7
TECHNICAL NOTE ON BRAZIL

In 2006, the education system in Brazil was revised to include one more year at the beginning of primary school, with the compulsory school age being lowered from seven to six years old. This change has been implemented in stages and will be completed in 2016. At the time the PISA 2012 survey took place, many of the 15-year-olds in Grade 7 had started their education under the previous system. They were therefore equivalent to Grade 6 students in the previous system. Since students below Grade 7 are not eligible for participation in PISA, the Grade 7 students in the sample were not included in the database.

Brazil also has many rural "multigrade" schools where it is difficult to identify the exact grade of each student, so not possible to identify students who are at least in Grade 7. The results for Brazil have therefore been analysed both with and without these rural schools. The results reported in the main chapters of this report are those of the Brazilian sample without the rural schools, while this annex gives the results for Brazil with the rural schools included.

[Part 1/1]

Table A7.1 Percentage of Brazilian students at each proficiency level on the mathematics scale and mathematics subscales

		Below Level 1		Level 1		Level 2		Level 3		Level 4		Level 5		Level 6	
		%	S.E.	%	S.E.	%	S.E.	%	S.E.	%	S.E.	%	S.E.	%	S.E.
Mathematics scale	All	36.9	(0.9)	31.4	(0.7)	19.7	(0.7)	8.5	(0.4)	2.7	(0.3)	0.7	(0.2)	0.0	(0.0)
	Boys	33.0	(1.1)	31.3	(0.9)	21.1	(0.8)	10.0	(0.7)	3.5	(0.4)	1.0	(0.2)	0.1	(0.0)
	Girls	40.4	(1.1)	31.6	(0.9)	18.4	(0.8)	7.2	(0.6)	2.0	(0.3)	0.4	(0.2)	0.0	(0.0)
Mathematics subscale *formulating*	All	44.4	(1.0)	27.8	(0.6)	17.1	(0.6)	7.2	(0.4)	2.6	(0.3)	0.8	(0.2)	0.2	(0.1)
	Boys	38.1	(1.1)	29.0	(0.9)	19.3	(0.7)	8.6	(0.7)	3.5	(0.5)	1.1	(0.3)	0.2	(0.1)
	Girls	50.2	(1.3)	26.7	(0.9)	15.0	(0.8)	5.9	(0.5)	1.7	(0.3)	0.5	(0.2)	0.1	(0.1)
Mathematics subscale *employing*	All	39.0	(0.9)	29.7	(0.6)	19.1	(0.6)	8.5	(0.4)	2.9	(0.4)	0.7	(0.2)	0.1	(0.0)
	Boys	35.2	(1.0)	29.6	(0.9)	20.6	(0.9)	9.7	(0.6)	3.8	(0.5)	1.0	(0.3)	0.1	(0.1)
	Girls	42.6	(1.1)	29.8	(0.8)	17.8	(0.8)	7.3	(0.6)	2.0	(0.3)	0.5	(0.2)	0.1	(0.1)
Mathematics subscale *interpreting*	All	31.5	(0.9)	30.8	(0.7)	22.6	(0.8)	10.8	(0.5)	3.4	(0.4)	0.7	(0.2)	0.1	(0.0)
	Boys	29.5	(1.1)	29.7	(0.9)	23.4	(1.0)	12.1	(0.7)	4.2	(0.5)	1.0	(0.2)	0.1	(0.0)
	Girls	33.4	(1.1)	31.8	(0.9)	21.9	(0.8)	9.7	(0.6)	2.7	(0.4)	0.4	(0.1)	0.0	(0.0)
Mathematics subscale *change and relationships*	All	47.8	(1.1)	23.6	(0.7)	15.9	(0.7)	8.0	(0.6)	3.2	(0.4)	1.1	(0.2)	0.3	(0.1)
	Boys	44.2	(1.2)	23.7	(0.8)	17.0	(0.8)	9.2	(0.6)	4.0	(0.4)	1.5	(0.3)	0.4	(0.1)
	Girls	51.1	(1.3)	23.6	(0.9)	14.9	(0.8)	7.0	(0.7)	2.5	(0.5)	0.7	(0.2)	0.2	(0.1)
Mathematics subscale *space and shape*	All	41.5	(1.0)	30.3	(0.7)	18.2	(0.6)	7.0	(0.4)	2.3	(0.3)	0.6	(0.2)	0.1	(0.0)
	Boys	36.0	(1.1)	30.4	(0.8)	20.9	(0.8)	8.5	(0.5)	3.2	(0.4)	0.9	(0.3)	0.2	(0.1)
	Girls	46.6	(1.2)	30.2	(0.9)	15.7	(0.7)	5.6	(0.5)	1.5	(0.3)	0.3	(0.1)	0.1	(0.0)
Mathematics subscale *quantity*	All	38.1	(1.1)	26.6	(0.8)	19.6	(0.6)	10.1	(0.5)	4.1	(0.4)	1.2	(0.3)	0.2	(0.1)
	Boys	34.7	(1.3)	26.6	(1.1)	20.2	(0.8)	11.5	(0.7)	5.1	(0.5)	1.6	(0.3)	0.3	(0.1)
	Girls	41.3	(1.3)	26.6	(1.2)	19.1	(0.8)	8.9	(0.6)	3.1	(0.4)	0.8	(0.2)	0.1	(0.1)
Mathematics subscale *uncertainty and data*	All	27.8	(1.0)	35.1	(1.0)	24.7	(0.8)	9.6	(0.5)	2.4	(0.4)	0.3	(0.1)	0.0	c
	Boys	25.7	(1.0)	33.7	(1.1)	25.7	(1.0)	11.3	(0.7)	3.1	(0.5)	0.4	(0.1)	0.0	c
	Girls	29.7	(1.2)	36.4	(1.1)	23.9	(0.9)	8.1	(0.6)	1.8	(0.3)	0.2	(0.1)	0.0	c
Computer-based mathematics scale	All	23.6	(1.8)	28.8	(1.2)	26.8	(1.6)	13.4	(0.9)	5.7	(1.0)	1.6	(0.5)	0.2	(0.1)
	Boys	20.3	(1.9)	27.1	(1.5)	27.5	(1.7)	15.0	(1.1)	7.6	(1.4)	2.1	(0.6)	0.4	(0.2)
	Girls	26.6	(2.2)	30.3	(1.5)	26.1	(2.1)	11.8	(1.1)	4.1	(0.8)	1.1	(0.5)	0.1	(0.1)
Combined mathematics scale	All	27.8	(1.7)	32.7	(1.3)	23.4	(1.3)	11.3	(0.9)	3.9	(0.7)	0.9	(0.3)	0.1	(0.1)
	Boys	23.7	(1.9)	31.7	(1.5)	24.5	(1.5)	13.4	(1.4)	5.2	(0.9)	1.2	(0.4)	0.2	(0.2)
	Girls	31.6	(2.1)	33.6	(1.8)	22.3	(1.5)	9.2	(1.2)	2.7	(0.7)	0.5	(0.2)	0.0	(0.0)

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[Part 1/1]

Table A7.2 Percentage of Brazilian students at each proficiency level on the reading scale

		Below Level 1b		Level 1b		Level 1a		Level 2		Level 3		Level 4		Level 5		Level 6	
		%	S.E.	%	S.E.	%	S.E.	%	S.E.	%	S.E.	%	S.E.	%	S.E.	%	S.E.
Reading scale	All	4.6	(0.4)	15.8	(0.6)	30.4	(0.8)	29.4	(0.7)	15.1	(0.6)	4.2	(0.4)	0.5	(0.1)	0.0	(0.0)
	Boys	6.9	(0.6)	20.0	(0.9)	31.8	(0.9)	25.9	(0.9)	11.7	(0.8)	3.3	(0.4)	0.4	(0.1)	0.0	c
	Girls	2.4	(0.3)	11.9	(0.6)	29.2	(1.1)	32.6	(1.0)	18.3	(1.1)	5.1	(0.5)	0.6	(0.2)	0.0	(0.0)
Combined reading scale	All	3.4	(0.7)	12.8	(1.1)	27.6	(1.4)	31.5	(1.5)	19.0	(1.3)	5.3	(0.8)	0.5	(0.2)	0.0	(0.0)
	Boys	5.1	(1.0)	15.1	(1.3)	29.7	(1.7)	29.3	(1.9)	15.6	(1.3)	4.7	(0.9)	0.4	(0.2)	0.0	c
	Girls	1.9	(0.5)	10.7	(1.2)	25.5	(1.8)	33.4	(2.0)	22.0	(1.6)	5.8	(0.8)	0.6	(0.2)	0.0	(0.0)

		Below Level 2		Level 2		Level 3		Level 4		Above Level 4	
		%	S.E.	%	S.E.	%	S.E.	%	S.E.	%	S.E.
Digital reading scale	All	39.3	(2.1)	29.6	(1.3)	21.8	(1.3)	7.9	(1.0)	1.3	(0.3)
	Boys	43.9	(2.4)	28.4	(1.9)	19.7	(1.7)	6.9	(1.1)	1.1	(0.5)
	Girls	35.1	(2.1)	30.7	(1.5)	23.8	(1.5)	8.9	(1.1)	1.5	(0.4)

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Table A7.3 **Percentage of Brazilian students at each proficiency level on the science scale**

		Below Level 1		Level 1		Level 2		Level 3		Level 4		Level 5		Level 6	
		%	S.E.	%	S.E.	%	S.E.	%	S.E.	%	S.E.	%	S.E.	%	S.E.
Science scale	All	19.9	(0.8)	35.4	(0.8)	29.8	(0.8)	12.0	(0.6)	2.6	(0.3)	0.3	(0.1)	0.0	c
	Boys	20.8	(1.0)	34.1	(0.9)	29.5	(0.9)	12.3	(0.8)	3.0	(0.4)	0.3	(0.1)	0.0	c
	Girls	19.1	(0.9)	36.5	(1.0)	30.2	(1.0)	11.7	(0.9)	2.3	(0.4)	0.3	(0.1)	0.0	c

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Table A7.4 **Top performers in mathematics, reading and science in Brazil**

	15-year-old students who are:														Percentage of top performers in mathematics who are also top performers in reading and science	
	not top performers in any of the three domains		top performers only in mathematics		top performers only in reading		top performers only in science		top performers in mathematics and reading but not in science		top performers in mathematics and science but not in reading		top performers in reading and science but not in mathematics		top performers in all three domains			
	%	S.E.	%	S.E.	%	S.E.	%	S.E.	%	S.E.	%	S.E.	%	S.E.	%	S.E.	%	S.E.
All	98.9	(0.2)	0.4	(0.1)	0.3	(0.1)	0.1	(0.0)	0.1	(0.1)	0.1	(0.0)	0.0	(0.0)	0.1	(0.1)	13.6	(7.5)
Boys	98.7	(0.3)	0.7	(0.2)	0.2	(0.1)	0.1	(0.1)	0.1	(0.1)	0.1	(0.1)	0.0	c	0.1	(0.1)	9.8	(6.4)
Girls	99.1	(0.3)	0.2	(0.1)	0.4	(0.1)	0.1	(0.1)	0.1	(0.1)	0.1	(0.0)	0.0	(0.0)	0.1	(0.1)	21.6	(15.2)

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Table A7.5 **Mean score, variation and gender differences in student performance in Brazil**

	All students				Gender differences						Percentiles									
	Mean score		Standard deviation		Boys		Girls		Difference (B - G)		5th		10th		25th		75th		90th		95th	
	Mean	S.E.	S.D.	S.E.	Mean score	S.E.	Mean score	S.E.	Score dif.	S.E.	Score	S.E.	Score	S.E.	Score	S.E.	Score	S.E.	Score	S.E.	Score	S.E.
Mathematics scale	389	(1.9)	78	(1.6)	397	(2.1)	380	(2.2)	**17**	(1.8)	271	(2.4)	294	(2.1)	334	(1.9)	437	(2.6)	492	(4.2)	528	(5.2)
Mathematics subscale *formulating*	373	(2.4)	88	(1.9)	387	(2.5)	361	(2.7)	**26**	(1.9)	237	(3.3)	265	(2.6)	314	(2.2)	428	(3.0)	487	(4.9)	527	(6.9)
Mathematics subscale *employing*	385	(2.0)	82	(1.7)	393	(2.1)	377	(2.3)	**17**	(1.9)	259	(2.7)	285	(2.0)	329	(1.9)	437	(2.6)	493	(4.1)	529	(6.2)
Mathematics subscale *interpreting*	398	(2.0)	81	(1.4)	404	(2.2)	393	(2.1)	**11**	(1.7)	268	(3.4)	296	(2.5)	343	(2.2)	450	(2.3)	505	(3.7)	537	(5.1)
Mathematics subscale *change and relationships*	368	(2.5)	100	(1.9)	377	(2.7)	359	(2.8)	**18**	(2.2)	212	(3.4)	246	(3.2)	300	(2.9)	432	(3.1)	497	(5.0)	540	(6.7)
Mathematics subscale *space and shape*	378	(2.0)	82	(1.8)	390	(2.1)	367	(2.2)	**23**	(1.7)	251	(3.0)	279	(2.5)	324	(2.0)	428	(2.4)	482	(4.2)	519	(6.1)
Mathematics subscale *quantity*	389	(2.3)	92	(1.6)	399	(2.5)	381	(2.7)	**18**	(2.2)	246	(3.3)	275	(3.3)	326	(2.5)	449	(2.9)	511	(4.2)	550	(5.5)
Mathematics subscale *uncertainty and data*	400	(1.9)	72	(1.4)	405	(2.1)	394	(2.0)	**11**	(1.5)	286	(2.5)	311	(2.4)	352	(2.0)	445	(2.2)	492	(3.5)	522	(4.5)
Computer-based mathematics scale	418	(4.5)	84	(3.0)	429	(4.8)	408	(4.5)	**21**	(2.4)	289	(5.9)	316	(4.4)	362	(4.9)	471	(5.5)	528	(8.8)	565	(10.6)
Combined mathematics scale	406	(3.7)	78	(2.5)	416	(4.1)	396	(3.7)	**21**	(2.3)	289	(4.6)	312	(3.7)	352	(3.7)	454	(4.8)	510	(7.7)	543	(8.7)
Reading scale	407	(2.0)	86	(1.2)	390	(2.3)	422	(2.1)	**-32**	(2.0)	266	(3.5)	297	(2.8)	348	(2.4)	465	(2.6)	518	(3.1)	550	(3.7)
Digital reading scale	431	(4.8)	95	(2.7)	420	(5.4)	441	(4.6)	**-21**	(3.1)	271	(8.0)	308	(8.0)	369	(6.9)	497	(5.7)	550	(5.5)	580	(6.1)
Combined reading scale	420	(4.1)	86	(2.3)	407	(4.7)	432	(3.9)	**-25**	(2.8)	277	(6.9)	308	(6.2)	362	(5.1)	480	(5.2)	530	(5.2)	559	(6.1)
Science scale	402	(2.1)	79	(1.4)	402	(2.3)	401	(2.2)	0	(1.7)	275	(3.1)	302	(2.4)	348	(1.9)	454	(2.7)	505	(3.5)	536	(4.5)

Note: Values that are statistically significant are indicated in bold (see Annex A3).

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