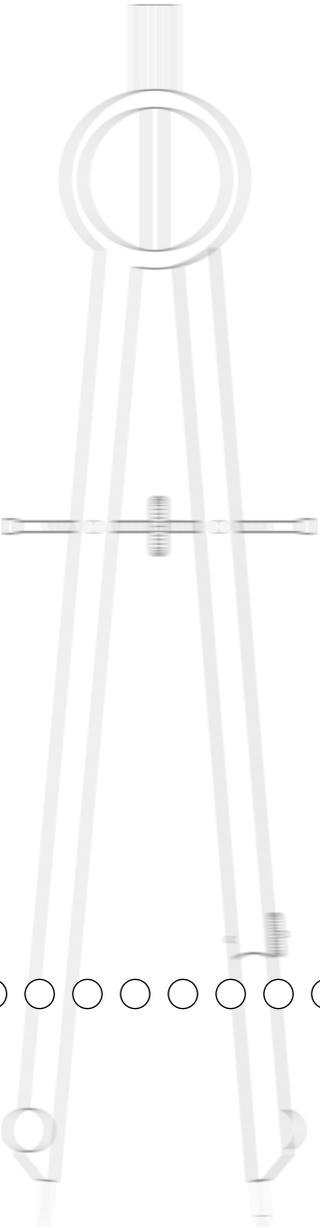


Implementation of the Sample Design

Pierre Foy
Marc Joncas







9

Implementation of the Sample Design

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Marc Joncas

9.1 Overview

The selection of valid and efficient samples is crucial to the quality and success of an international comparative study. The accuracy of the survey results depends on the quality of the sampling information available when planning the sample, and on the care with which the sampling activities themselves are conducted. For TIMSS 1999, National Research Coordinators (NRCs) worked on all phases of sampling with staff from Statistics Canada. NRCs were trained in how to select the school and student samples and how to use the sampling software. In consultation with the TIMSS 1999 sampling referee (Keith Rust, Westat), staff from Statistics Canada reviewed the national sampling plans, sampling data, sampling frames, and sample selection. This documentation was used by the International Study Center (ISC) jointly with Statistics Canada, the sampling referee, and the Project Management Team (PMT) to evaluate the quality of the samples. Summaries of the sample design for each country, including details of population coverage and exclusions, stratification variables, and participation rates, are provided in Appendix C.

9.2 TIMSS 1999 Target Population

In IEA studies, the target population for all countries is known as the *international desired population*. The international desired population for TIMSS 1999 was the following¹:

- All students enrolled in the upper of the two adjacent grades that contain the largest proportion of 13-year-olds at the time of testing.

The TIMSS 1999 target grade was intended to be the upper grade of the TIMSS 1995 population 2 definition and was expected to be the eighth grade in most countries. This would allow countries participating in both TIMSS 1995 and TIMSS 1999 to establish a trend line of comparable achievement data.

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1. See Chapter 2 for more information the TIMSS 1999 sample design.

Exhibit 9.1 summarizes the grades identified as the target grade in all participating countries. For most countries, the target grade did indeed turn out to be the eighth grade.² Only in Finland, Morocco, and some states in the Russian Federation was the seventh grade the target grade. In parts of Australia and New Zealand, the target grade was the ninth grade. Average student ages ranged from 13.8 in Finland and New Zealand to 15.5 in South Africa.

Exhibit 9.1 National Grade Definitions

Country	Country's Name for Grade Tested	Years of Formal Schooling	Mean Age of Students Tested
Australia	8 or 9	8 or 9	14.3
Belgium (Flemish)	2A & 2P	8	14.1
Bulgaria	8	8	14.8
Canada	8	8	14.0
Chile	8	8	14.4
Chinese Taipei	2nd Grade Junior High School	8	14.2
Cyprus	8	8	13.8
Czech Republic	8	9	14.4
England	Year 9	9	14.2
Finland	7	7	13.8
Hong Kong, SAR	Secondary 2	8	14.2
Hungary	8	8	14.4
Indonesia	2nd Grade Junior High School	8	14.6
Iran, Islamic Rep.	9	8	14.6
Israel	9	8	14.1
Italy	3rd Grade Middle School	8	14.0
Japan	2nd Grade Lower Secondary	8	14.4
Jordan	8	8	14.0
Korea, Rep. of	2nd Grade Middle School	8	14.4
Latvia (LSS)	8	8	14.5
Lithuania	9	8.5	15.2
Macedonia, Rep. of	8	8	14.6
Malaysia	Form 2	8	14.4
Moldova	8	9	14.4
Morocco	7	7	14.2
Netherlands	Secondary 2	8	14.2
New Zealand	Year 9	8.5 to 9.5	14.0
Philippines	1st Year High School	7	14.1
Romania	8	8	14.8
Russian Federation	8	7 or 8	14.1
Singapore	Secondary 2	8	14.4
Slovak Republic	8	8	14.3
Slovenia	8	8	14.8
South Africa	8	8	15.5
Thailand	Secondary 2	8	14.5
Tunisia	8	8	14.8
Turkey	8	8	14.2
United States	8	8	14.2

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- In TIMSS in 1995, Romania and Slovenia selected the eighth grade as the upper of their target grades. Subsequently, analysis of the age distributions in those countries showed that there students were older, on average, than students in most other countries. Both countries chose to test the same grade again in 1999 in order to have comparable trend data.

9.2.1 Coverage And Exclusions

Exhibit 9.2 summarizes national coverage and exclusions in the TIMSS 1999 target populations. National coverage of the international desired target population was generally comprehensive. Only Latvia and Lithuania chose a national desired population less than the international desired population.³ Because coverage of the international desired population fell below 65% for Latvia, the Latvian results have been labelled “Latvia (LSS),” for Latvian-Speaking Schools. Coverage was more inclusive in Lithuania, but since it was less than 100%, the Lithuanian results were footnoted to reflect this situation. The Lithuanian results were also footnoted to indicate that although Lithuania tested the same cohort of students as other countries, it did so later in 1999, at the beginning of the next school year.

School-level exclusions generally consisted of schools for the disabled and very small schools; however, there were some national deviations that are documented in Appendix C. Within-school exclusions generally consisted of disabled students and students that could not be assessed in the language of the test. Only in Israel did the level of excluded students exceed the TIMSS maximum of 10%, and this was reflected in a footnote in the international reports. A few countries had no within-school exclusions.

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3. The Latvian population was restricted to schools catering to Latvian-speaking students only, and the Lithuanian population to schools catering to Lithuanian-speaking students only.

Exhibit 9.2 National Coverage and Overall Exclusion Rates

	International Desired Population		National Desired Population		Overall
	Coverage	Notes on Coverage	School-Level Exclusions	Within-Sample Exclusions	Overall Exclusions
Australia	100%		1%	1%	2%
Belgium (Flemish)	100%		1%	0%	1%
Bulgaria	100%		5%	0%	5%
Canada	100%		4%	2%	6%
Chile	100%		3%	0%	3%
Chinese Taipei	100%		1%	1%	2%
Cyprus	100%		0%	1%	1%
Czech Republic	100%		5%	0%	5%
England	100%		2%	3%	5%
Finland	100%		3%	0%	4%
Hong Kong, SAR	100%		1%	0%	1%
Hungary	100%		4%	0%	4%
Indonesia	100%		0%	0%	0%
Iran, Islamic Rep.	100%		4%	0%	4%
Israel	100%		8%	8%	16%
Italy	100%		4%	2%	7%
Japan	100%		1%	0%	1%
Jordan	100%		2%	1%	3%
Korea, Rep. of	100%		2%	2%	4%
Latvia	61%	Latvian-speaking students only	4%	0%	4%
Lithuania	87%	Lithuanian-speaking students only	5%	0%	5%
Macedonia, Rep. of	100%		1%	0%	1%
Malaysia	100%		5%	0%	5%
Moldova	100%		2%	0%	2%
Morocco	100%		1%	0%	1%
Netherlands	100%		1%	0%	1%
New Zealand	100%		2%	1%	2%
Philippines	100%		3%	0%	3%
Romania	100%		4%	0%	4%
Russian Federation	100%		1%	1%	2%
Singapore	100%		0%	0%	0%
Slovak Republic	100%		7%	0%	7%
Slovenia	100%		3%	0%	3%
South Africa	100%		2%	0%	2%
Thailand	100%		3%	0%	3%
Tunisia	100%		0%	0%	0%
Turkey	100%		2%	0%	2%
United States	100%		0%	4%	4%

9.3 Sampling of Schools and Students

9.3.1 General Sample Design

The basic sample design used in TIMSS 1999 was a two-stage stratified cluster design.⁴ The first stage consisted of a sample of schools and the second stage of samples of intact mathematics classrooms from the target grade in the sampled schools.

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4. The TIMSS sample design is described in Chapter 2.

The TIMSS 1999 design allowed countries to stratify the school sampling frame to improve the precision of survey results. Some countries used an explicit stratification procedure, whereby schools were categorized according to some criterion (e.g., regions of the country). This allowed them to ensure that a predetermined number of schools were selected from each explicit stratum. Countries also used an implicit stratification procedure, whereby the school sampling frame was sorted according to a set of stratification variables prior to sampling. This approach provided a convenient method of allocating the school sample in proportion to the size of the implicit stratum when used in conjunction with a systematic PPS method.

Most countries sampled approximately 150 schools and one intact classroom (with all of its students) within each school. Countries that selected larger school samples included large countries, such as the United States and the Russian Federation, and countries such as Australia, Canada, and Turkey that required accurate survey estimates for regions or provinces. Schools were selected with probability proportional to size, and classrooms with equal probabilities.⁵ Some countries chose to sample more than one classroom per selected school. Details of the sampling of schools and students for each country are provided in Appendix C.

9.3.2 Target Population Sizes

Exhibit 9.3 summarizes the number of schools and students in each country's target population, as well as the sample sizes of schools and students that participated in the study. Most of the target population sizes are derived from the sampling frames from which the TIMSS samples were drawn. The school and student population sizes for Turkey, however, were estimated from the number of students in the primary sampling units (provinces) that Turkey sampled. In addition, the school and student population sizes for the United States and the Russian Federation were not computed from the sampling frame, but were provided by their respective NRC. Using the sampling weights computed for each country (see Chapter 11), TIMSS derived an estimate of the student population size, which matched closely the student population size from the sampling frame (see Exhibit 9.3).

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5. Because of large class sizes, Morocco chose a sub-sample of students from each sampled classroom.

Exhibit 9.3 Population and Sample Sizes

Country	Population		Sample		
	Schools	Students	Schools	Students	Est. Pop.
Australia	2072	255648	170	4032	260130
Belgium (Flemish)	697	67765	135	5259	65539
Bulgaria	2160	85066	163	3272	88389
Canada	5925	395960	385	8770	371061
Chile	4044	238894	185	5907	208910
Chinese Taipei	758	342753	150	5772	310428
Cyprus	61	9862	61	3116	9785
Czech Republic	1606	124583	142	3453	119462
England	3784	566590	128	2960	552231
Finland	649	64386	159	2920	59665
Hong Kong SAR	408	79397	137	5179	79097
Hungary	2693	114156	147	3183	111298
Indonesia	18565	2167498	150	5848	1956221
Iran Islamic Rep.	24560	1576860	170	5301	1655741
Israel	834	95031	139	4195	81486
Italy	5488	582110	180	3328	548711
Japan	10102	1449671	140	4745	1411038
Jordan	1276	100176	147	5052	89171
Korea Rep. of	2504	635080	150	6114	609483
Latvia	586	19663	145	2873	18122
Lithuania	954	41824	150	2361	40452
Macedonia Rep. of	355	30387	149	4023	30280
Malaysia	1642	378762	150	5577	397762
Moldova	1216	64241	150	3711	59956
Morocco	1094	330186	173	5402	347675
Netherlands	730	175513	126	2962	198144
New Zealand	379	51716	152	3613	51553
Philippines	5001	1233150	150	6601	1078093
Romania	6691	258833	147	3425	259621
Russian Federation	58595	2100000	189	4332	2057412
Singapore	145	41700	145	4966	41346
Slovak Republic	1392	76790	145	3497	72521
Slovenia	434	24645	149	3109	23514
South Africa	7234	968857	194	8146	844705
Thailand	7839	790788	150	5732	727087
Tunisia	533	140580	149	5051	139639
Turkey	6531	636242	204	7841	618058
United States	41499	3464627	221	9072	3336295

9.3.3 Participation Rates

Weighted school, student, and overall participation rates were computed for each participating country using the procedures documented in Chapter 11. Countries understood that the goal for sampling participation was 100% for all sampled schools and students, and that the guidelines established by TIMSS in 1995 for reporting achievement data for countries securing less than full participation also would be applied in 1999.

According to TIMSS, countries would be assigned to one of three categories on the basis of their sampling participation (Exhibit 9.4). Countries in Category 1 were considered to have met the TIMSS sampling requirements and to have an acceptable participation rate. Countries in Category 2 met the sampling requirements only after including replacement schools. Countries that failed to meet the participation requirements even with the use of replacement schools were assigned to Category 3. One of the main goals for quality data in TIMSS 1999 was to have as many countries as possible achieve Category 1 status, and to have no countries in Category 3.

Exhibit 9.4 Categories of Sampling Participation

Category 1	<p>Acceptable sampling participation rate without the use of replacement schools. In order to be placed in this category, a country had to have:</p> <ul style="list-style-type: none"> • An unweighted school response rate without replacement of at least 85% (after rounding to nearest whole percent) AND an unweighted student response rate (after rounding) of at least 85% <p>OR</p> <ul style="list-style-type: none"> • A weighted school response rate without replacement of at least 85% (after rounding to nearest whole percent) AND a weighted student response rate (after rounding) of at least 85% <p>OR</p> <ul style="list-style-type: none"> • The product of the (unrounded) weighted school response rate without replacement and the (unrounded) weighted student response rate of at least 75% (after rounding to the nearest whole percent). <p>Countries in this category appeared in the tables and figures in international reports without annotation ordered by achievement as appropriate.</p>
Category 2	<p>Acceptable sampling participation rate only when replacement schools were included. A country was placed in category 2 if:</p> <ul style="list-style-type: none"> • It failed to meet the requirements for Category 1 but had either an unweighted or weighted school response rate without replacement of at least 50% (after rounding to the nearest percent) <p>AND HAD EITHER</p> <ul style="list-style-type: none"> • An unweighted school response rate with replacement of at least 85% (after rounding to nearest whole percent) AND an unweighted student response rate (after rounding) of at least 85% <p>OR</p> <ul style="list-style-type: none"> • A weighted school response rate with replacement of at least 85% (after rounding to nearest whole percent) AND a weighted student response rate (after rounding) of at least 85% <p>OR</p> <ul style="list-style-type: none"> • The product of the (unrounded) weighted school response rate with replacement and the (unrounded) weighted student response rate of at least 75% (after rounding to the nearest whole percent). <p>Countries in this category were annotated in the tables and figures in international reports and ordered by achievement as appropriate.</p>
Category 3	<p>Unacceptable sampling response rate even when replacement schools are included. Countries that could provide documentation to show that they complied with TIMSS sampling procedures and requirements but did not meet the requirements for Category 1 or Category 2 were placed in Category 3.</p> <p>Countries in this category would appear in a separate section of the achievement tables, below the other countries, in international reports. These countries were presented in alphabetical order.</p>

Exhibits 9.5 through 9.8 present the school, student, and overall participation rates and achieved sample sizes for each participating country. As can be seen from these exhibits, all TIMSS 1999 countries except England met the requirements for category 1. England had an unweighted school participation rate before including replacement schools of 51%. With replacement this increased to 85%, which meant that England belonged in category 2. Accordingly the results for England were annotated with an obelisk in the achievement exhibits in the international reports. In TIMSS 1999, no country was assigned to category 3.

9.4 Summary

Population coverage and sampling participation rates were good for all countries that participated in TIMSS 1999. Unlike the situation in 1995 when a number of countries had difficulty securing acceptable participation rates or complying fully with sampling guidelines, all countries met the standards for compliance in 1999 and had acceptable participation rates (although one country had to rely on replacement schools). Full details of the outcome of the TIMSS sampling in each country is presented in Appendix C.

Exhibit 9.5 School Participation Rates & Sample Sizes

Country	School Participation Before Replacement (Weighted Percentage)	School Participation After Replacement (Weighted Percentage)	Number of Schools in Original Sample	Number of Eligible Schools in Original Sample	Number of Schools in Original Sample That Participated	Number of Replacement Schools That Participated	Total Number of Schools That Participated
Australia	83%	93%	184	182	152	18	170
Belgium (Flemish)	72%	89%	150	150	106	29	135
Bulgaria	97%	97%	172	169	163	0	163
Canada	92%	95%	410	398	376	9	385
Chile	98%	100%	186	185	181	4	185
Chinese Taipei	100%	100%	150	150	150	0	150
Cyprus	100%	100%	61	61	61	0	61
Czech Republic	94%	100%	150	142	136	6	142
England	49%	85%	150	150	76	52	128
Finland	97%	100%	160	160	155	4	159
Hong Kong, SAR	75%	76%	180	180	135	2	137
Hungary	98%	98%	150	150	147	0	147
Indonesia	84%	100%	150	150	132	18	150
Iran, Islamic Rep.	96%	100%	170	170	164	6	170
Israel	98%	100%	150	139	137	2	139
Italy	94%	100%	180	180	170	10	180
Japan	93%	93%	150	150	140	0	140
Jordan	99%	100%	150	147	146	1	147
Korea, Rep. of	100%	100%	150	150	150	0	150
Latvia	96%	98%	150	148	143	2	145
Lithuania	100%	100%	150	150	150	0	150
Macedonia, Rep. of	99%	99%	150	150	149	0	149
Malaysia	99%	100%	150	150	148	2	150
Moldova	96%	100%	150	150	145	5	150
Morocco	99%	99%	174	174	172	1	173
Netherlands	62%	85%	150	148	86	40	126
New Zealand	93%	97%	156	156	145	7	152
Philippines	98%	100%	150	150	148	2	150
Romania	98%	98%	150	150	147	0	147
Russian Federation	98%	100%	190	190	186	3	189
Singapore	100%	100%	145	145	145	0	145
Slovak Republic	95%	96%	150	150	143	2	145
Slovenia	98%	99%	150	150	147	2	149
South Africa	85%	91%	225	219	183	11	194
Thailand	93%	100%	150	150	143	7	150
Tunisia	84%	100%	150	149	126	23	149
Turkey	99%	100%	204	204	202	2	204
United States	83%	90%	250	246	202	19	221

Exhibit 9.6 Student Participation Rates & Sample Sizes

Country	Within School Student Participation (Weighted Percentage)	Number of Sampled Students in Participating Schools	Number of Students Withdrawn from Class/School	Number of Students Excluded	Number of Students Eligible	Number of Students Absent	Number of Students Assessed
Australia	90%	4600	96	53	4451	419	4032
Belgium (Flemish)	97%	5387	12	0	5375	116	5259
Bulgaria	96%	3461	63	0	3398	126	3272
Canada	96%	9490	84	245	9161	391	8770
Chile	96%	6283	119	18	6146	239	5907
Chinese Taipei	99%	5889	30	42	5817	45	5772
Cyprus	97%	3296	38	32	3226	110	3116
Czech Republic	96%	3640	24	0	3616	163	3453
England	90%	3400	27	115	3258	298	2960
Finland	96%	3060	17	13	3030	110	2920
Hong Kong SAR	98%	5310	18	1	5291	112	5179
Hungary	95%	3350	0	0	3350	167	3183
Indonesia	97%	6162	106	1	6055	207	5848
Iran Islamic Rep.	98%	5497	104	0	5393	92	5301
Israel	94%	4670	29	187	4454	259	4195
Italy	97%	3531	23	86	3422	94	3328
Japan	95%	4996	15	12	4969	224	4745
Jordan	99%	5300	130	42	5128	76	5052
Korea Rep. of	100%	6285	29	128	6128	14	6114
Latvia	93%	3128	16	4	3108	235	2873
Lithuania	89%	2668	0	0	2668	307	2361
Macedonia Rep. of	98%	4096	0	0	4096	73	4023
Malaysia	99%	5713	98	0	5615	38	5577
Moldova	98%	3824	23	0	3801	90	3711
Morocco	92%	5841	42	0	5799	397	5402
Netherlands	95%	3099	12	0	3087	125	2962
New Zealand	94%	3966	96	22	3848	235	3613
Philippines	92%	7591	461	0	7130	529	6601
Romania	98%	3514	36	0	3478	53	3425
Russian Federation	97%	4557	48	34	4475	143	4332
Singapore	98%	5100	37	0	5063	97	4966
Slovak Republic	98%	3695	149	0	3546	49	3497
Slovenia	95%	3287	0	4	3283	174	3109
South Africa	93%	9071	256	0	8815	669	8146
Thailand	99%	5831	59	0	5772	40	5732
Tunisia	98%	5189	45	0	5144	93	5051
Turkey	99%	7972	49	0	7923	82	7841
United States	94%	9981	115	142	9724	652	9072

Exhibit 9.7 Unweighted Participation Rates

Country	School Participation Before Replacement	School Participation After Replacement	Student Participation	Overall Participation Before Replacement	Overall Participation After Replacement
Australia	84%	93%	91%	76%	85%
Belgium (Flemish)	71%	90%	98%	69%	88%
Bulgaria	96%	96%	96%	93%	93%
Canada	94%	97%	96%	90%	93%
Chile	98%	100%	96%	94%	96%
Chinese Taipei	100%	100%	99%	99%	99%
Cyprus	100%	100%	97%	97%	97%
Czech Republic	96%	100%	95%	91%	95%
England	51%	85%	91%	46%	78%
Finland	97%	99%	96%	93%	96%
Hong Kong, SAR	75%	76%	98%	73%	75%
Hungary	98%	98%	95%	93%	93%
Indonesia	88%	100%	97%	85%	97%
Iran, Islamic Rep.	96%	100%	98%	95%	98%
Israel	99%	100%	94%	93%	94%
Italy	94%	100%	97%	92%	97%
Japan	93%	93%	95%	89%	89%
Jordan	99%	100%	99%	98%	99%
Korea, Rep. of	100%	100%	100%	100%	100%
Latvia	97%	98%	92%	89%	91%
Lithuania	100%	100%	88%	88%	88%
Macedonia, Rep. of	99%	99%	98%	98%	98%
Malaysia	99%	100%	99%	98%	99%
Moldova	97%	100%	98%	94%	98%
Morocco	99%	99%	93%	92%	93%
Netherlands	58%	85%	96%	56%	82%
New Zealand	93%	97%	94%	87%	91%
Philippines	99%	100%	93%	91%	93%
Romania	98%	98%	98%	97%	97%
Russian Federation	98%	99%	97%	95%	96%
Singapore	100%	100%	98%	98%	98%
Slovak Republic	95%	97%	99%	94%	95%
Slovenia	98%	99%	95%	93%	94%
South Africa	84%	89%	92%	77%	82%
Thailand	95%	100%	99%	95%	99%
Tunisia	85%	100%	98%	83%	98%
Turkey	99%	100%	99%	98%	99%
United States	82%	90%	93%	77%	84%

Exhibit 9.8 Weighted Participation Rates

Country	School Participation Before Replacement	School Participation After Replacement	Student Participation	Overall Participation Before Replacement	Overall Participation After Replacement
Australia	83%	93%	90%	75%	84%
Belgium (Flemish)	72%	89%	97%	70%	87%
Bulgaria	97%	97%	96%	93%	93%
Canada	92%	95%	96%	88%	92%
Chile	98%	100%	96%	94%	96%
Chinese Taipei	100%	100%	99%	99%	99%
Cyprus	100%	100%	97%	97%	97%
Czech Republic	94%	100%	96%	90%	96%
England	49%	85%	90%	45%	77%
Finland	97%	100%	96%	93%	96%
Hong Kong, SAR	75%	76%	98%	74%	75%
Hungary	98%	98%	95%	93%	93%
Indonesia	84%	100%	97%	81%	97%
Iran, Islamic Rep.	96%	100%	98%	95%	98%
Israel	98%	100%	94%	93%	94%
Italy	94%	100%	97%	91%	97%
Japan	93%	93%	95%	89%	89%
Jordan	99%	100%	99%	98%	99%
Korea, Rep. of	100%	100%	100%	100%	100%
Latvia	96%	98%	93%	89%	91%
Lithuania	100%	100%	89%	89%	89%
Macedonia, Rep. of	99%	99%	98%	98%	98%
Malaysia	99%	100%	99%	98%	99%
Moldova	96%	100%	98%	94%	98%
Morocco	99%	99%	92%	91%	92%
Netherlands	62%	85%	95%	59%	81%
New Zealand	93%	97%	94%	87%	91%
Philippines	98%	100%	92%	91%	92%
Romania	98%	98%	98%	97%	97%
Russian Federation	98%	100%	97%	95%	97%
Singapore	100%	100%	98%	98%	98%
Slovak Republic	95%	96%	98%	93%	94%
Slovenia	98%	99%	95%	93%	94%
South Africa	85%	91%	93%	79%	84%
Thailand	93%	100%	99%	93%	99%
Tunisia	84%	100%	98%	82%	98%
Turkey	99%	100%	99%	98%	99%
United States	83%	90%	94%	78%	85%