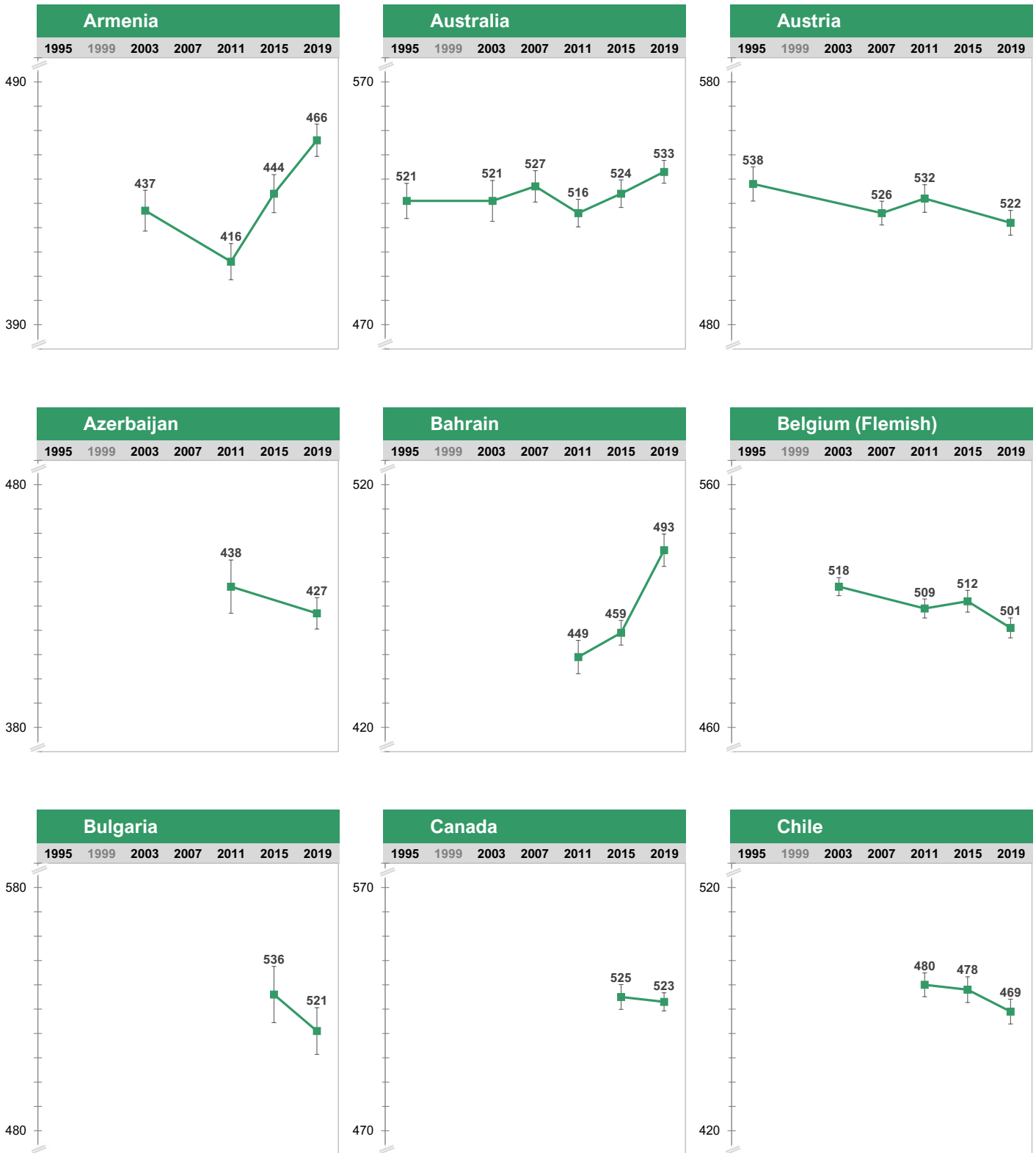


Exhibit 2.3: Trend Plots of Average Science Achievement Across Assessment Years[◇]

This exhibit displays changes in achievement for the countries and benchmarking participants that have comparable data from previous TIMSS assessments. The accompanying table (Exhibit 2.4) provides details, including statistical significance. See Appendix A for country participation in previous assessments.

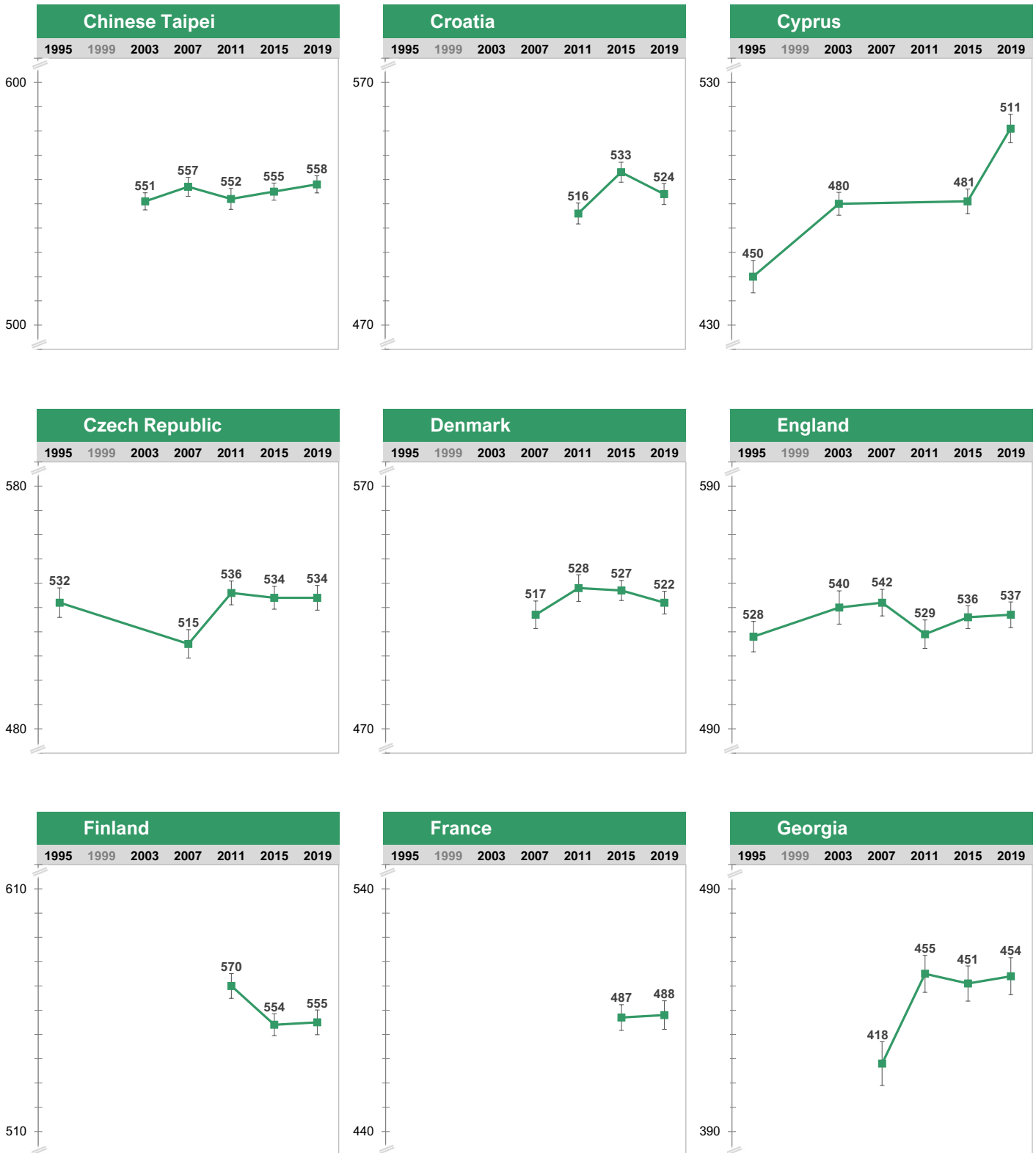


[◇] There was no TIMSS fourth grade assessment in 1999. See Appendix A for country participation in previous TIMSS assessments.
 The scale interval is 10 points for each country, but a different part of the scale is shown according to each country's average achievement.
 I The black bars represent the 95% confidence interval.

Exhibit 2.3: Trend Plots of Average Science Achievement Across Assessment Years [◇]

(Continued)

This exhibit displays changes in achievement for the countries and benchmarking participants that have comparable data from previous TIMSS assessments. The accompanying table (Exhibit 2.4) provides details, including statistical significance. See Appendix A for country participation in previous assessments.

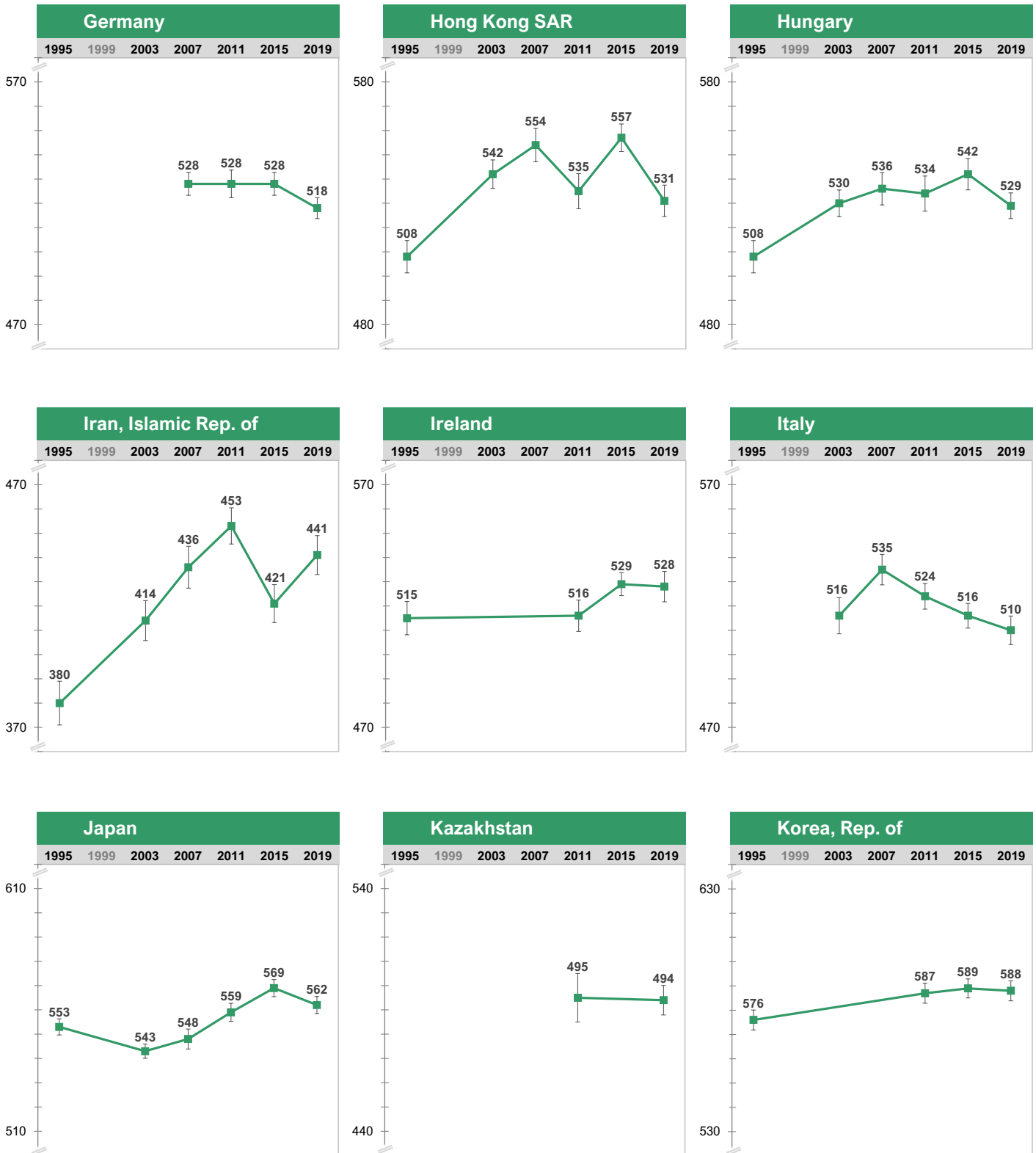


◇ There was no TIMSS fourth grade assessment in 1999. See Appendix A for country participation in previous TIMSS assessments. The scale interval is 10 points for each country, but a different part of the scale is shown according to each country's average achievement. I. The black bars represent the 95% confidence interval.

Exhibit 2.3: Trend Plots of Average Science Achievement Across Assessment Years[◇]

(Continued)

This exhibit displays changes in achievement for the countries and benchmarking participants that have comparable data from previous TIMSS assessments. The accompanying table (Exhibit 2.4) provides details, including statistical significance. See Appendix A for country participation in previous assessments.

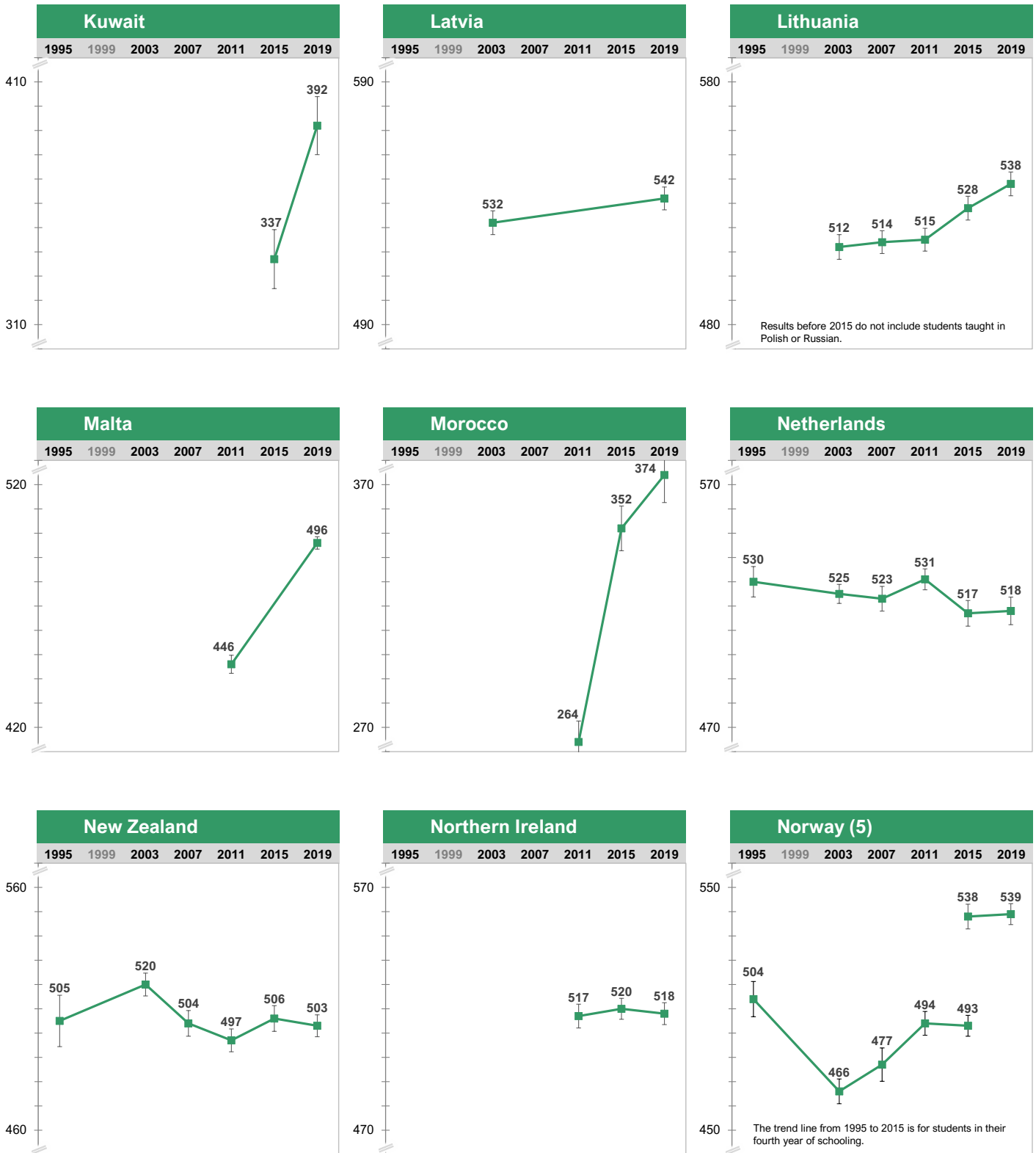


[◇] There was no TIMSS fourth grade assessment in 1999. See Appendix A for country participation in previous TIMSS assessments. The scale interval is 10 points for each country, but a different part of the scale is shown according to each country's average achievement. I. The black bars represent the 95% confidence interval.

Exhibit 2.3: Trend Plots of Average Science Achievement Across Assessment Years ◊

(Continued)

This exhibit displays changes in achievement for the countries and benchmarking participants that have comparable data from previous TIMSS assessments. The accompanying table (Exhibit 2.4) provides details, including statistical significance. See Appendix A for country participation in previous assessments.

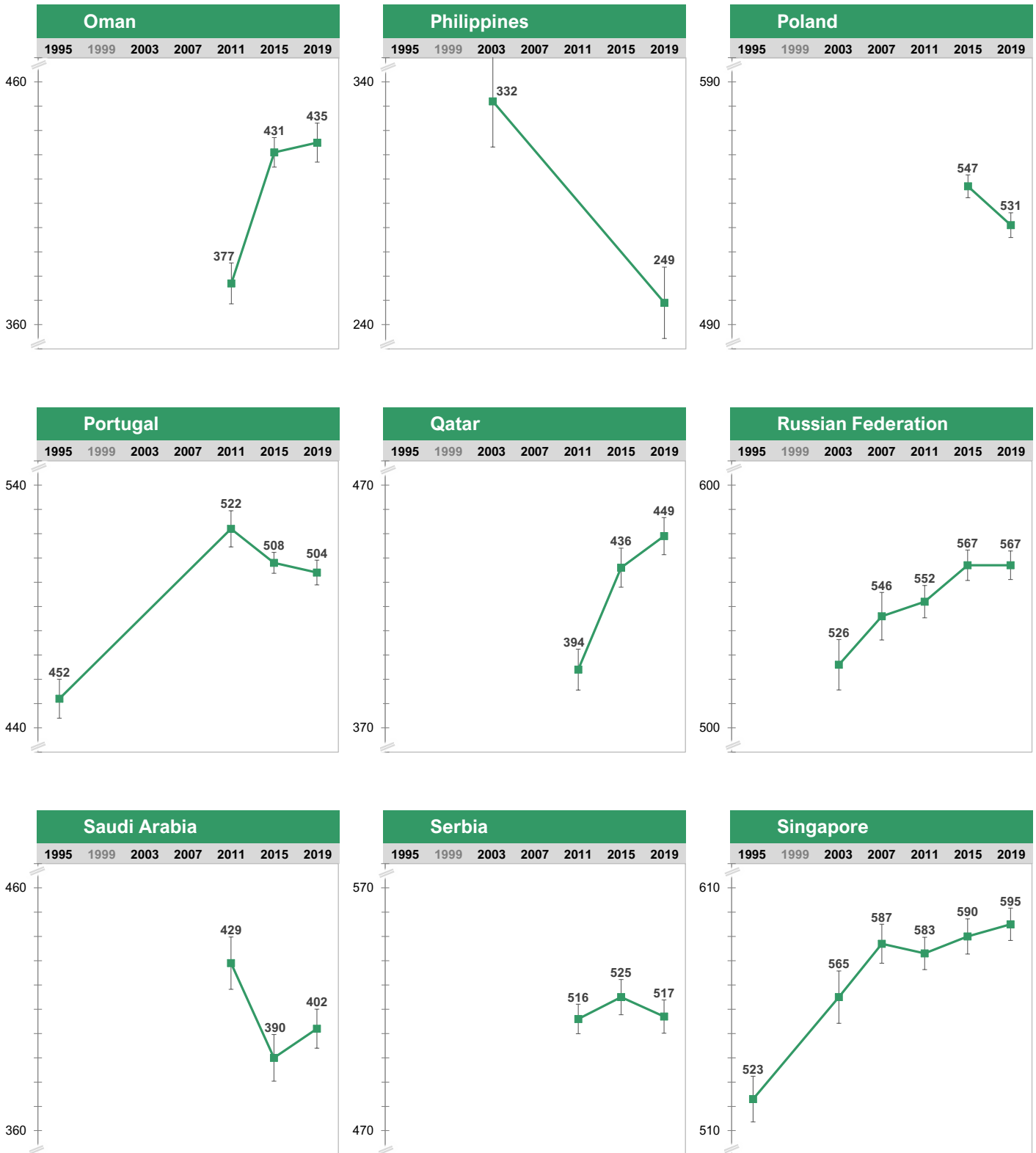


◊ There was no TIMSS fourth grade assessment in 1999. See Appendix A for country participation in previous TIMSS assessments. The scale interval is 10 points for each country, but a different part of the scale is shown according to each country's average achievement. I The black bars represent the 95% confidence interval.

Exhibit 2.3: Trend Plots of Average Science Achievement Across Assessment Years [◇]

(Continued)

This exhibit displays changes in achievement for the countries and benchmarking participants that have comparable data from previous TIMSS assessments. The accompanying table (Exhibit 2.4) provides details, including statistical significance. See Appendix A for country participation in previous assessments.

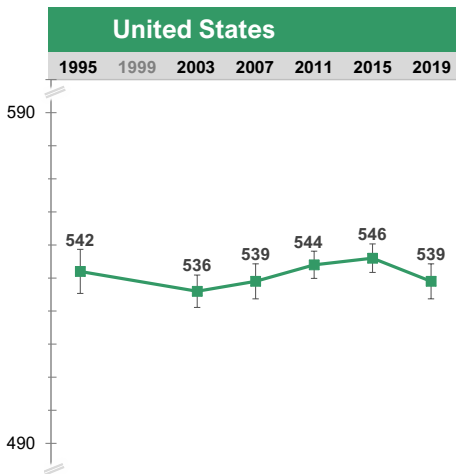
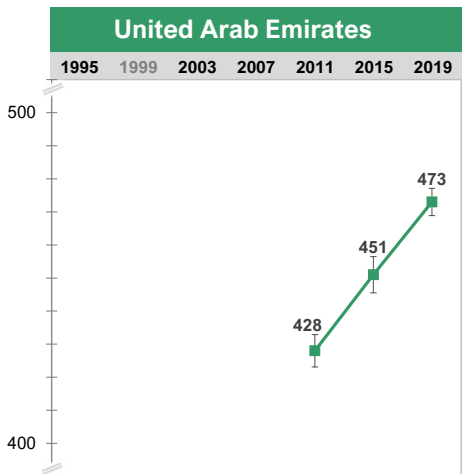
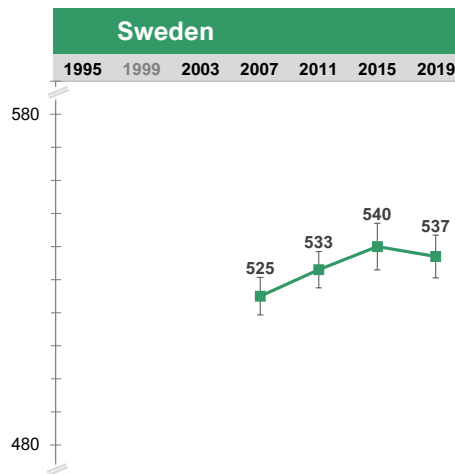
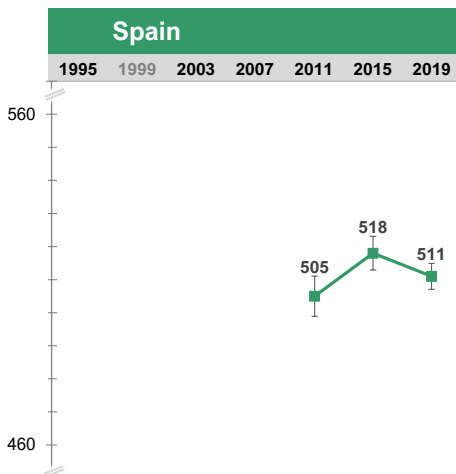
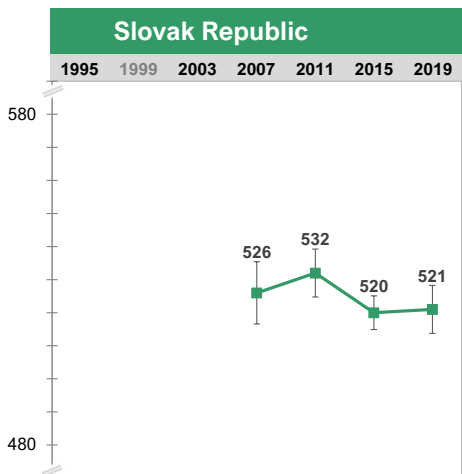


◇ There was no TIMSS fourth grade assessment in 1999. See Appendix A for country participation in previous TIMSS assessments.
 The scale interval is 10 points for each country, but a different part of the scale is shown according to each country's average achievement.
 I The black bars represent the 95% confidence interval.

Exhibit 2.3: Trend Plots of Average Science Achievement Across Assessment Years[◇]

(Continued)

This exhibit displays changes in achievement for the countries and benchmarking participants that have comparable data from previous TIMSS assessments. The accompanying table (Exhibit 2.4) provides details, including statistical significance. See Appendix A for country participation in previous assessments.



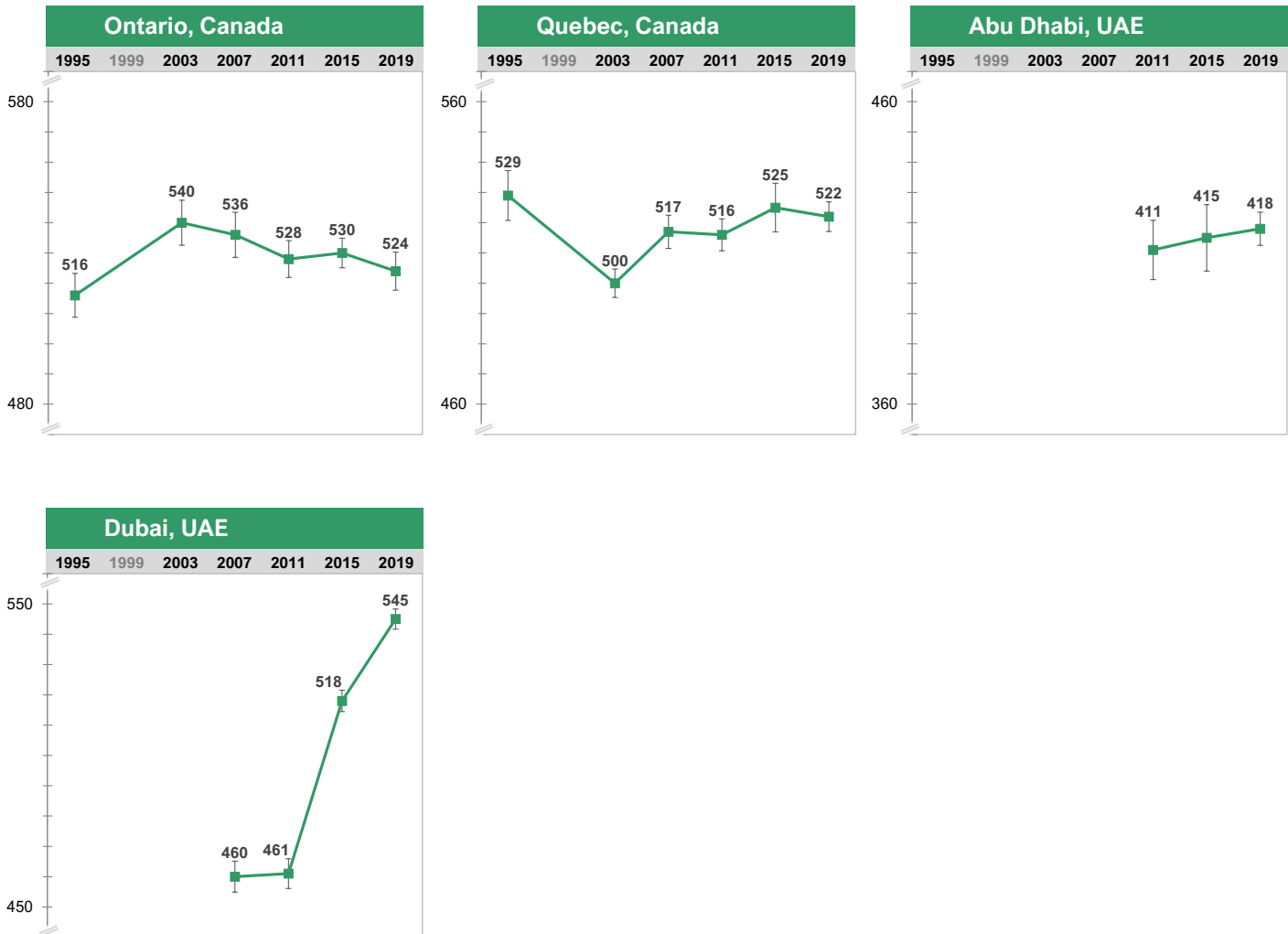
◇ There was no TIMSS fourth grade assessment in 1999. See Appendix A for country participation in previous TIMSS assessments.
 The scale interval is 10 points for each country, but a different part of the scale is shown according to each country's average achievement.
 I. The black bars represent the 95% confidence interval.

Exhibit 2.3: Trend Plots of Average Science Achievement Across Assessment Years[◇]

(Continued)

This exhibit displays changes in achievement for the countries and benchmarking participants that have comparable data from previous TIMSS assessments. The accompanying table (Exhibit 2.4) provides details, including statistical significance. See Appendix A for country participation in previous assessments.

Benchmarking Participants

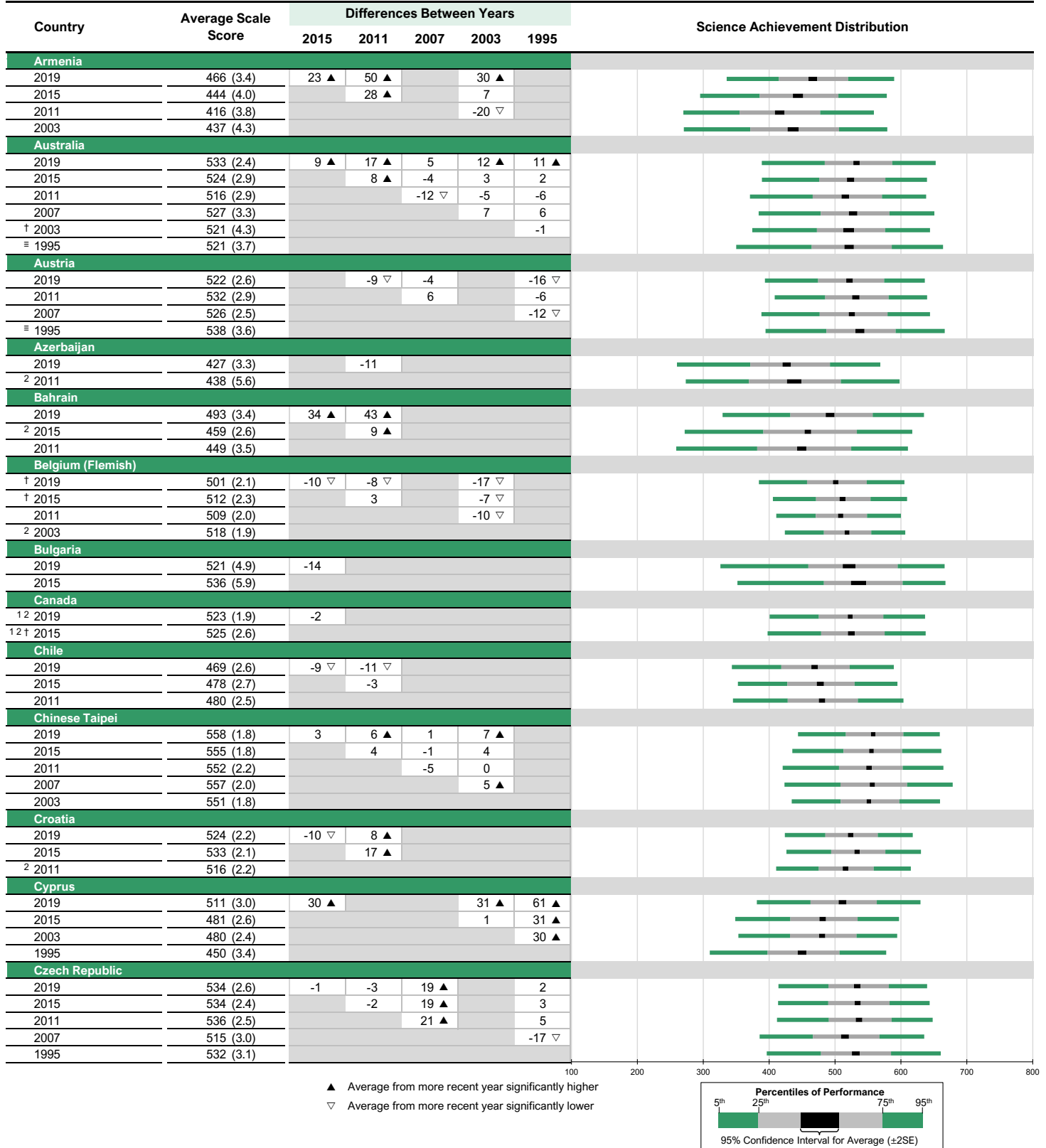


[◇] There was no TIMSS fourth grade assessment in 1999. See Appendix A for country participation in previous TIMSS assessments.
 The scale interval is 10 points for each country, but a different part of the scale is shown according to each country's average achievement.
 I The black bars represent the 95% confidence interval.

SOURCE: IEA's Trends in International Mathematics and Science Study - TIMSS 2019
 Downloaded from <http://timss2019.org/download>

Exhibit 2.4: Differences in Average Science Achievement Across Assessment Years

Read across the row to determine if the performance in the row year is significantly higher (▲) or significantly lower (▼) than the performance in the column year.



See Appendix A for country participation in previous TIMSS assessments.

See Appendix B.2 for population coverage notes 1, 2, and 3. See Appendix B.5 for sampling guidelines and sampling participation notes †, ‡, and ≡.

() Standard errors appear in parentheses. Because of rounding some results may appear inconsistent.

Exhibit 2.4: Differences in Average Science Achievement Across Assessment Years

(Continued)

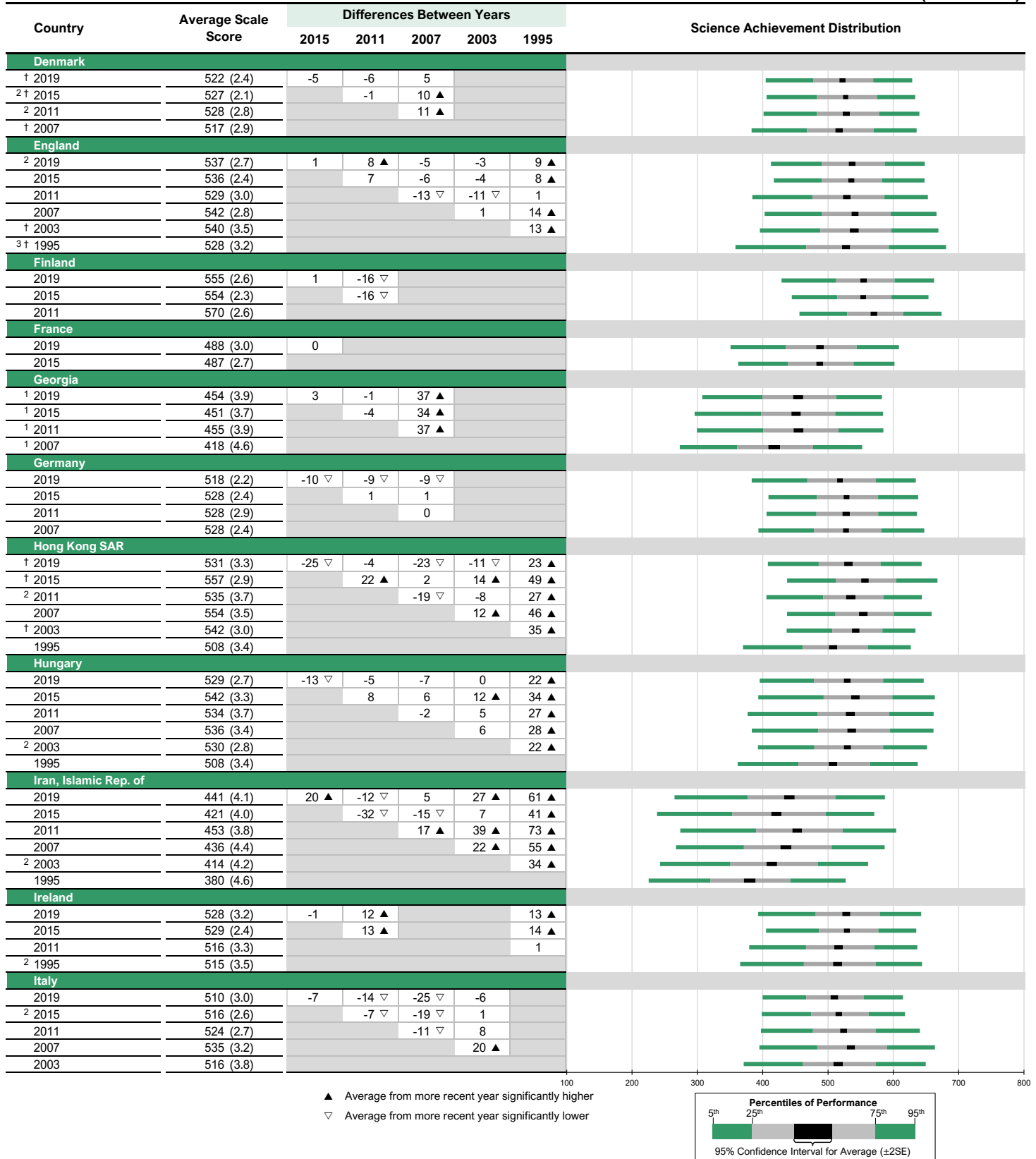
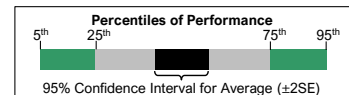


Exhibit 2.4: Differences in Average Science Achievement Across Assessment Years

(Continued)

Country	Average Scale Score	Differences Between Years					Science Achievement Distribution
		2015	2011	2007	2003	1995	
Japan							
2019	562 (1.8)	-7 ▽	3	14 ▲	18 ▲	8 ▲	
2015	569 (1.8)		10 ▲	21 ▲	26 ▲	16 ▲	
2011	559 (1.9)			11 ▲	15 ▲	5 ▲	
2007	548 (2.1)				4	-5	
2003	543 (1.5)					-10 ▽	
1995	553 (1.7)						
Kazakhstan							
² 2019	494 (3.1)		0				
² 2011	495 (5.1)						
Korea, Rep. of							
2019	588 (2.1)	-2	1			12 ▲	
2015	589 (2.0)		3			14 ▲	
2011	587 (2.1)					11 ▲	
² 1995	576 (2.1)						
Kuwait							
2019	392 (6.1)	55 ▲					
^ψ 2015	337 (6.2)						
Latvia							
² 2019	542 (2.4)				10 ▲		
2003	532 (2.5)						
Lithuania							
² 2019	538 (2.5)	10 ▲	23 ▲	24 ▲	26 ▲		
² 2015	528 (2.5)		13 ▲	13 ▲	16 ▲		
^{1,2} 2011	515 (2.4)			0	3		
¹ 2007	514 (2.4)				2		
¹ 2003	512 (2.6)						
Malta							
2019	496 (1.3)		50 ▲				
2011	446 (1.9)						
Morocco							
^ψ 2019	374 (5.8)	22 ▲	110 ▲				
^ψ 2015	352 (4.7)		89 ▲				
[✱] 2011	264 (4.4)						
Netherlands							
[≡] 2019	518 (2.9)	1	-13 ▽	-5	-7	-12 ▽	
[†] 2015	517 (2.7)		-14 ▽	-6	-8 ▽	-13 ▽	
[†] 2011	531 (2.2)			8 ▲	6 ▲	1	
[‡] 2007	523 (2.6)				-2	-7	
[†] 2003	525 (2.0)					-5	
[≡] 1995	530 (3.2)						
New Zealand							
² 2019	503 (2.3)	-3	6	-2	-17 ▽	-3	
2015	506 (2.7)		9 ▲	1	-14 ▽	0	
2011	497 (2.4)			-7 ▽	-23 ▽	-8	
2007	504 (2.7)				-16 ▽	-1	
2003	520 (2.4)					15 ▲	
1995	505 (5.4)						
Northern Ireland							
[†] 2019	518 (2.3)	-1	2				
[‡] 2015	520 (2.2)		3				
[†] 2011	517 (2.5)						
Norway (5)							
[†] 2019	539 (2.2)	2					
2015	538 (2.6)						
Oman							
2019	435 (4.1)	4	58 ▲				
2015	431 (3.1)		54 ▲				
2011	377 (4.3)						
Philippines							
^{2, ✱} 2019	249 (7.5)				-83 ▽		
2003	332 (9.6)						
Poland							
2019	531 (2.6)	-16 ▽					
2015	547 (2.4)						

▲ Average from more recent year significantly higher
 ▽ Average from more recent year significantly lower



^ψ Reservations about reliability because the percentage of students with achievement too low for estimation exceeds 15% but does not exceed 25%.
[✱] Reservations about reliability because the percentage of students with achievement too low for estimation exceeds 25%.

Exhibit 2.4: Differences in Average Science Achievement Across Assessment Years

(Continued)

Country	Average Scale Score	Differences Between Years					Science Achievement Distribution
		2015	2011	2007	2003	1995	
Portugal							
² 2019	504 (2.6)	-4	-18 ▽			52 ▲	
² 2015	508 (2.2)		-14 ▽			56 ▲	
2011	522 (3.8)					70 ▲	
² 1995	452 (4.1)						
Qatar							
2019	449 (3.9)	13 ▲	55 ▲				
2015	436 (4.1)		42 ▲				
² 2011	394 (4.3)						
Russian Federation							
² 2019	567 (3.0)	0	15 ▲	21 ▲	41 ▲		
2015	567 (3.2)		15 ▲	21 ▲	41 ▲		
2011	552 (3.4)			6	26 ▲		
2007	546 (5.0)				20 ▲		
² 2003	526 (5.3)						
Saudi Arabia							
² 2019	402 (4.1)	12	-27 ▽				
2015	390 (4.9)		-39 ▽				
2011	429 (5.5)						
Serbia							
² 2019	517 (3.5)	-8	1				
³ 2015	525 (3.7)		9				
² 2011	516 (3.1)						
Singapore							
³ 2019	595 (3.4)	4	11 ▲	8	29 ▲	71 ▲	
² 2015	590 (3.7)		7	4	25 ▲	67 ▲	
² 2011	583 (3.4)			-3	18 ▲	60 ▲	
2007	587 (4.1)				22 ▲	63 ▲	
2003	565 (5.5)					42 ▲	
1995	523 (4.8)						
Slovak Republic							
² 2019	521 (3.7)	0	-11 ▽	-5			
2015	520 (2.6)		-11 ▽	-5			
2011	532 (3.7)			6			
2007	526 (4.8)						
Spain							
2019	511 (2.0)	-7 ▽	6				
² 2015	518 (2.6)		13 ▲				
2011	505 (3.1)						
Sweden							
2019	537 (3.3)	-3	4	12 ▲			
² 2015	540 (3.6)		7	15 ▲			
2011	533 (2.8)			9 ▲			
2007	525 (2.9)						
United Arab Emirates							
2019	473 (2.1)	21 ▲	45 ▲				
2015	451 (2.8)		23 ▲				
2011	428 (2.5)						
United States							
² † 2019	539 (2.7)	-7 ▽	-5	0	3	-3	
² † 2015	546 (2.2)		2	7 ▲	10 ▲	4	
² 2011	544 (2.1)			5	8 ▲	2	
² † 2007	539 (2.7)				3	-3	
† 2003	536 (2.5)					-6	
1995	542 (3.4)						

▲ Average from more recent year significantly higher
 ▽ Average from more recent year significantly lower

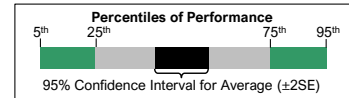
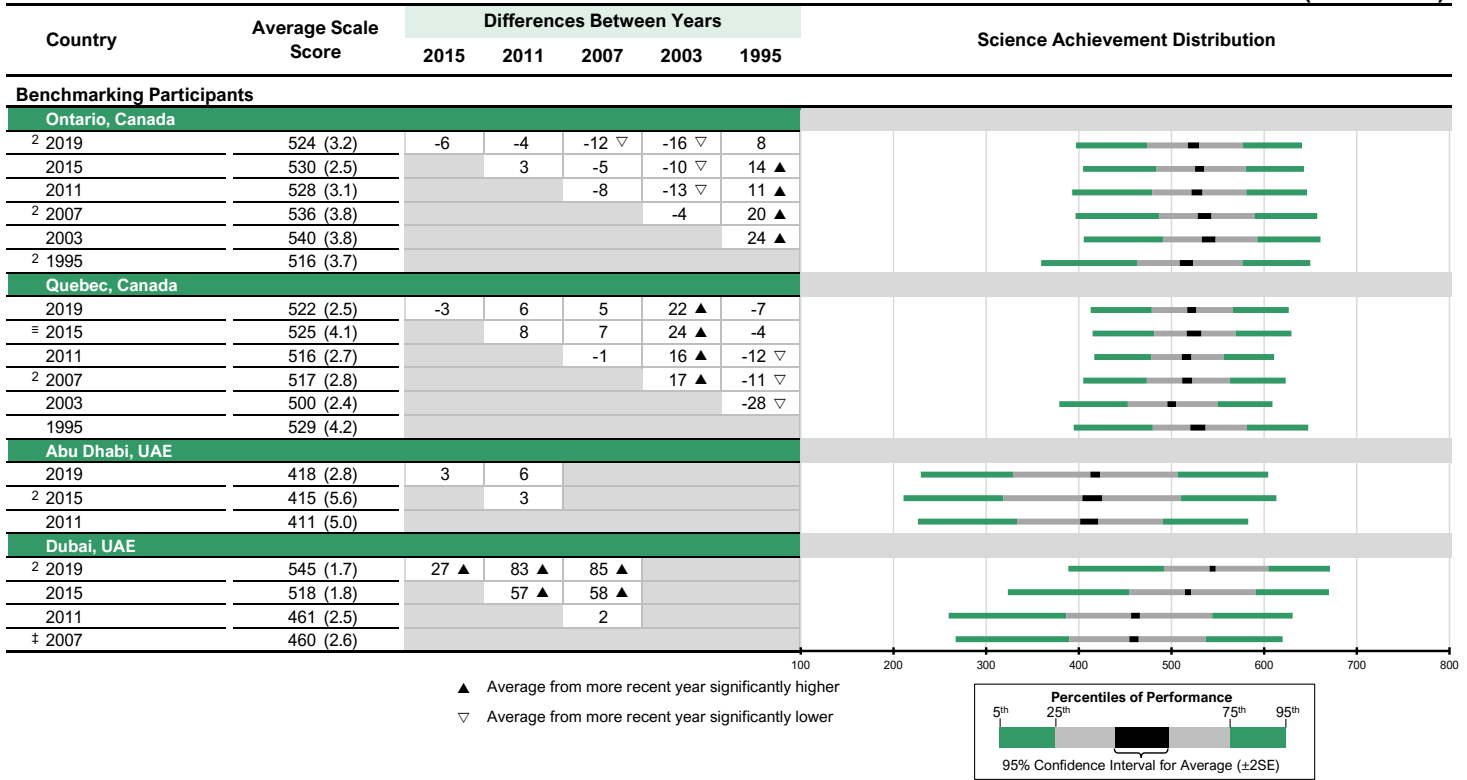


Exhibit 2.4: Differences in Average Science Achievement Across Assessment Years

(Continued)



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