

CHAPTER 3

Average Achievement
in Science
Content Areas



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Chapter 3 presents results by the major content areas in science to provide information about the possible effects of curricular variation on average achievement. Average performance is provided for six content areas: earth science; life science; physics; chemistry; environmental and resource issues; scientific inquiry and the nature of science. Information on trends also is provided for earth science, life science, physics, and chemistry.





Curriculum data collected as part of TIMSS 1995 and TIMSS 1999 indicate differences among countries in the structure of the science curriculum, especially in the grades at which topics are introduced, the relative emphasis given to topics, the time allocated to science education, and the expectations placed upon the students. The TIMSS curriculum frameworks were constructed to be powerful organizing tools, rich enough to make possible comparative analyses of curriculum and curriculum change in a wide variety of settings and from a variety of curriculum perspectives. The TIMSS 1999 science assessment, based upon the science framework, was designed to allow as fair comparisons as possible among participating countries, and maintained a common structure with TIMSS 1995 enabling the tracking of changes over time.¹

To facilitate comparative analyses of the science data, the TIMSS 1999

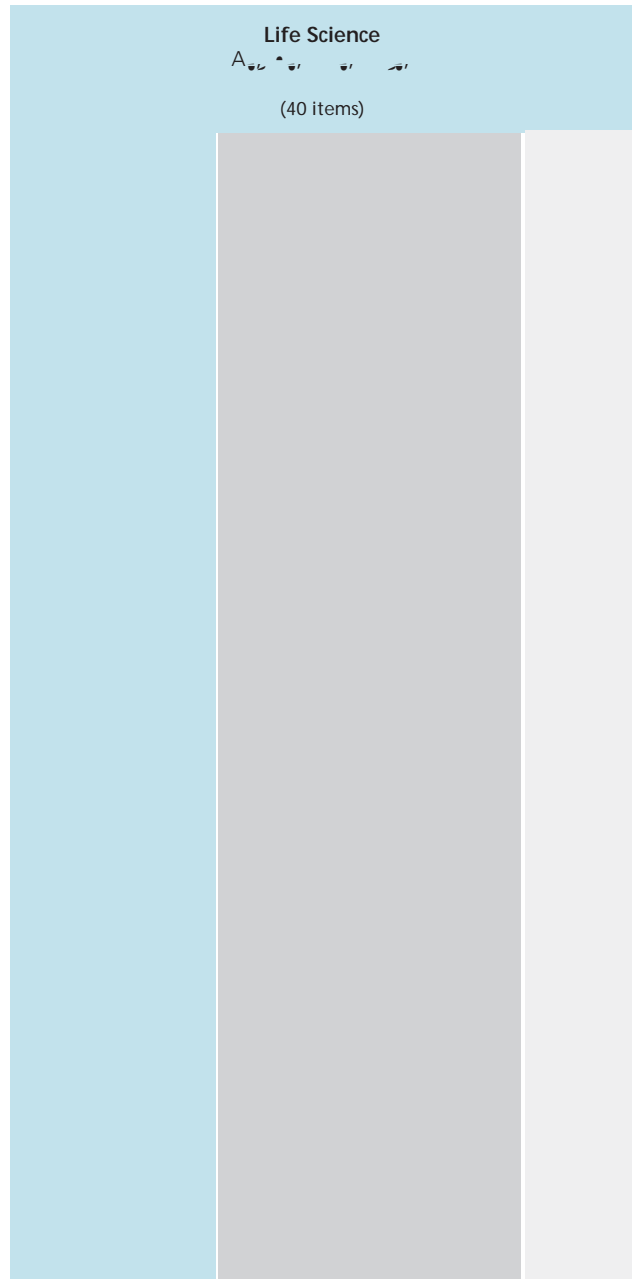
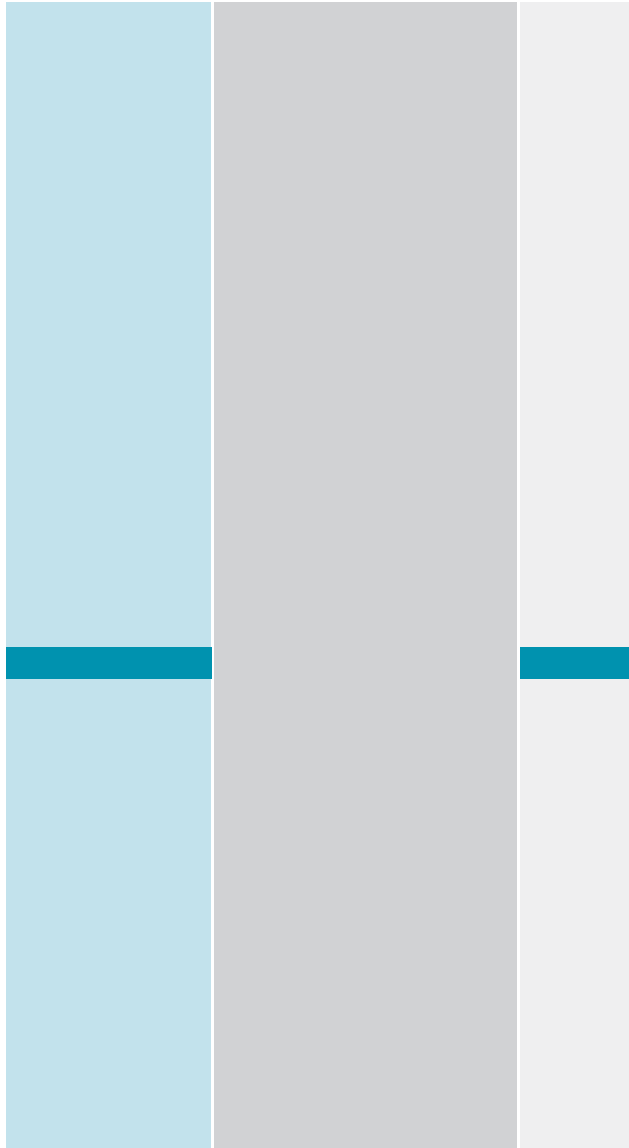
- Scientific inquiry and the nature of science

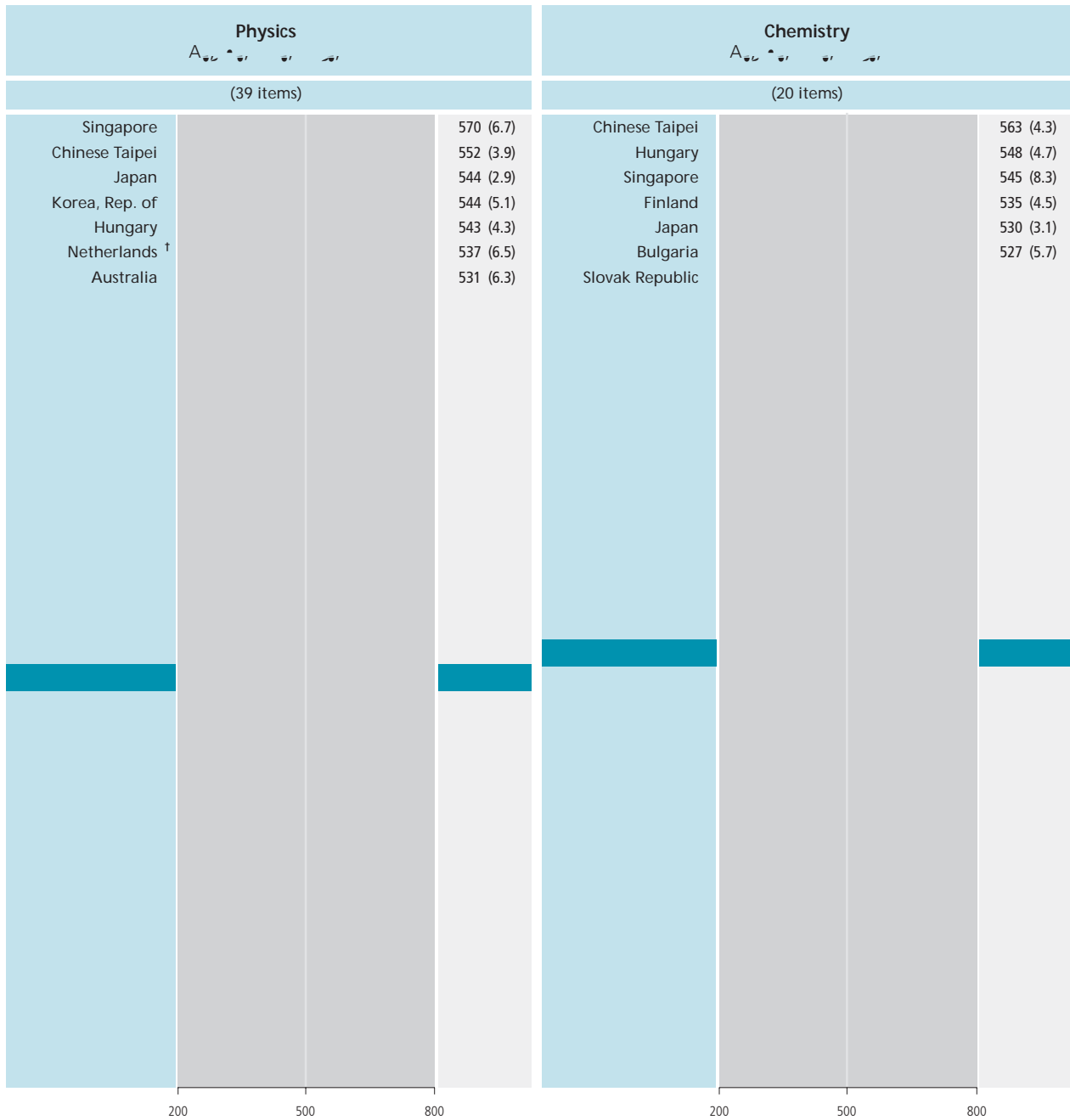
Incl de he nature of scientific knowledge; the scientific enterprise; in the action of science, technology, mathematics, and society; and the role, process, and consequences of conducting scientific investigation.

Chapter 3 presents average achievement for the six major content areas covered by the TIMSS 1999 science test. Gender differences in each content area are shown, and trends in achievement between 1995 and 1999

How Does Achievement Differ Across Science Content Areas?

Exhibit





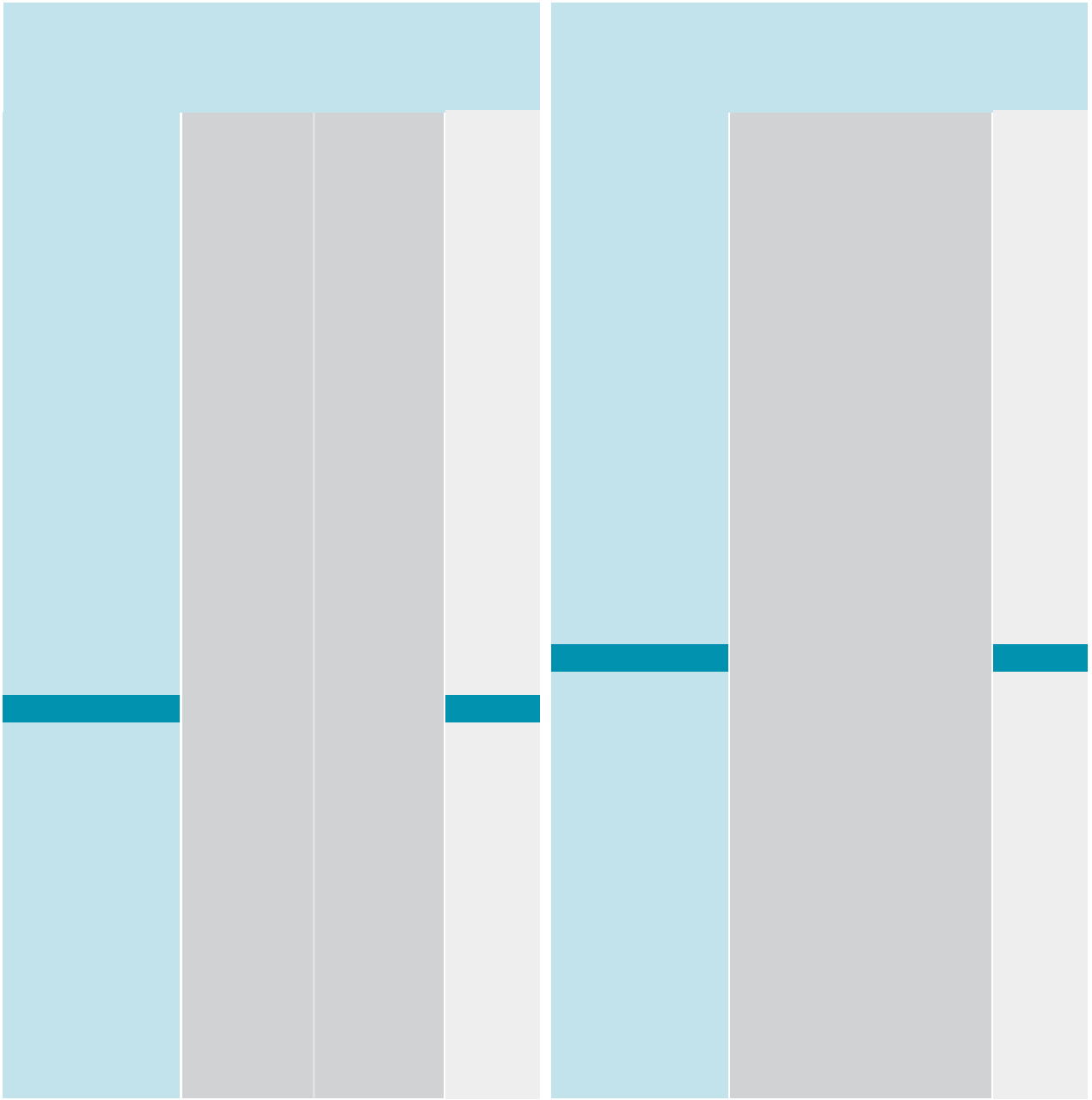
▲ Country average significantly higher than international average

● Country average not significantly different from international average

▼ Country average significantly lower than international average

Source: International Association for Educational Assessment






In Which Content Areas Are Countries Relatively Strong or Weak?

Exhibit 3.2 profiles the relative performance in science content areas within each country, highlighting any variation in performance. For each country, Exhibit 3.2 displays the difference between average performance in each content area and average performance overall. The profiles reveal that many countries performed relatively better or worse in some content areas than in others. For example, students in Bulgaria performed relatively better in chemistry, but less well in environmental and resource issues and in scientific inquiry and the nature of science.

The profiles of relative performance show substantially more variation across the content areas in some countries than in others. For example, in Indonesia, South Africa, and Thailand, there were differences of more than 61 scale-score points (approximately two-thirds of a standard deviation) between the highest and lowest content area averages. In contrast, in countries such as Australia, Cyprus, England, Finland, Hong Kong, Israel, Latvia (LSS), Malaysia, New Zealand, and the Philippines, the difference in average achievement across content areas was 25 scale-score points or less.

Across countries, earth science, life science, and physics were the content areas that least often featured either relatively strong or weak performance. In comparison, relatively stronger or weaker performance in chemistry, environmental and resource issues, and scientific inquiry and the nature of science were observed for a larger number of countries. Of the eight countries in which performance in chemistry was relatively strong, five were countries where the sciences were taught as separate subjects (generally earth science, biology, physics, and chemistry) by the eighth grade or less.



eighth grade (see Exhibit 5.1). Students in Singapore had relatively higher performance in physics and environmental and resource issues, and relatively lower performance in earth science. In contrast, students in Japan had lower performance in environmental and resource issues than in other science content areas.

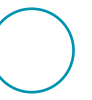
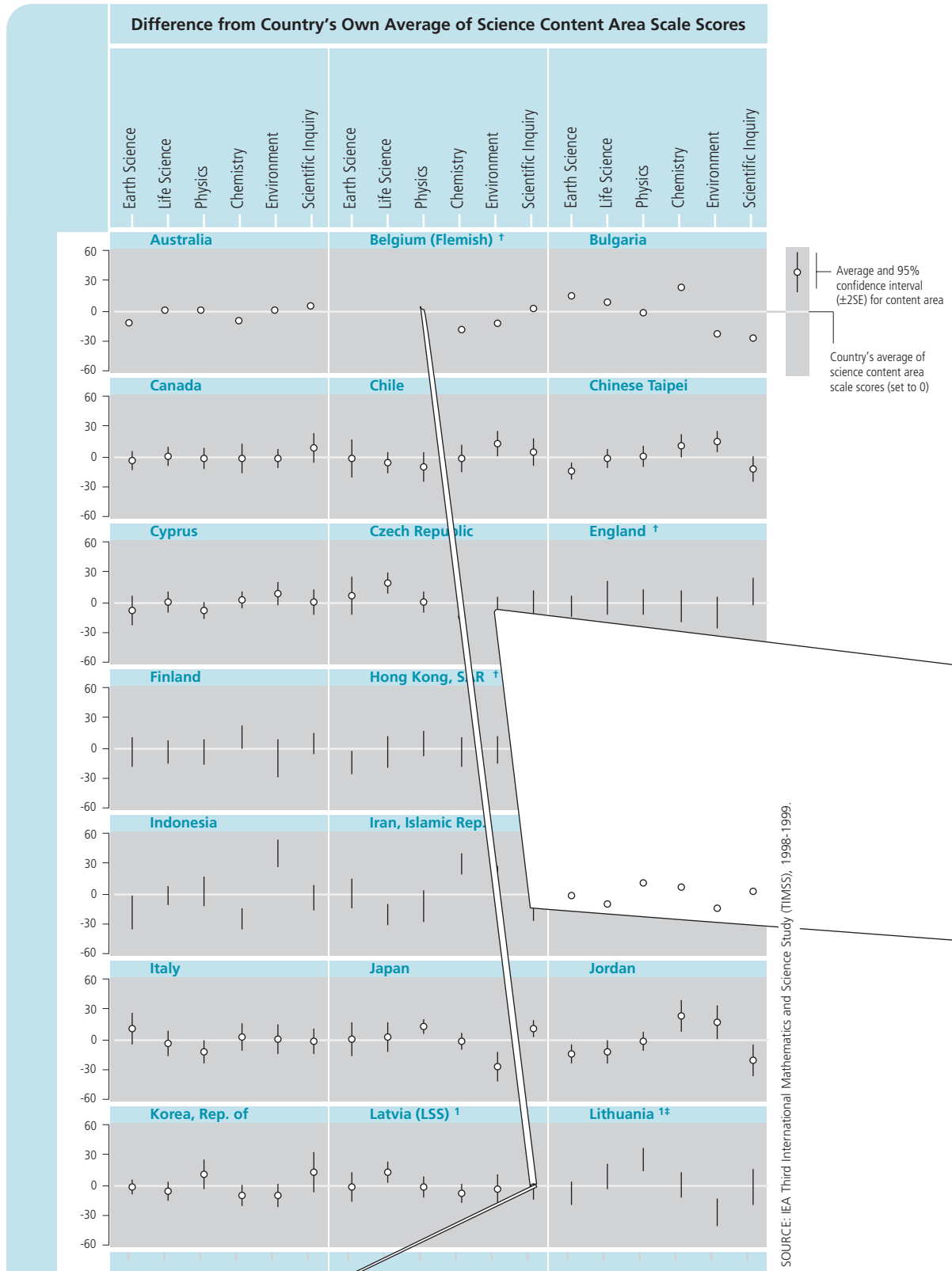


Exhibit 3.2 Profiles of Relative Performance in Science Content Areas



Difference from Country's Own Average of Science Content Area Scale Scores



	Average Scale Scores for Science Content Areas					
	Chemistry		Environmental and Resource Issues		Scientific Inquiry and the Nature of Science	
	Male	Female	Male	Female	Male	Female
Australia		▲		540 (9.0)	540 (8.3)	529 (3.9)
Belgium (Flemish) †				523 (8.1)	528 (5.7)	524 (7.2)
Bulgaria				493 (9.8)	482 (5.7)	476 (8.1)
Canada				529 (6.0)	535 (5.4)	530 (5.3)
Chile				529 (8.49)	439 (8.6)	442 (7.6)
Chinese Taipei				486 (4.35)	544 (5.3)	537 (5.4)
Cyprus				530 (6.1)	474 (4.7)	461 (6.2)
Czech Republic		▲		522 (5.46)	▲ 524 (4.9)	519 (8.9)
England †		▲			▲ 536 (5.7)	540 (8.3)
Finland					532 (5.4)	524 (7.1)
Hong Kong, SAR †					535 (3.2)	527 (4.0)
Hungary		▲			522 (5.9)	531 (7.0)
Indonesia					449 (8.2)	442 (5.0)
Iran, Islamic Rep.					439 (3.8)	451 (7.9)
Israel 2					475 (10.4)	477 (8.5)
Italy					▲ 486 (5.4)	492 (5.8)
Japan					546 (6.3)	540 (5.9)
Jordan					451 (5.4)	431 (8.0)
Korea, Rep. of					547 (10.1)	544 (6.5)
Latvia (LSS) 1		▲			495 (5.9)	495 (8.4)
Lithuania 1†					486 (6.0)	479 (8.0)
Macedonia, Rep. of					463 (5.0)	465 (5.5)
Malaysia					485 (6.4)	492 (7.4)
Moldova					467 (6.2)	476 (7.1)
Morocco					390 (6.5)	391 (5.9)
Netherlands †					539 (8.8)	530 (9.1)
New Zealand					530 (6.6)	513 (11.4)
Philippines					412 (6.0)	393 (6.8)
Romania					457 (6.8)	455 (6.9)
Russian Federation					491 (4.3)	491 (9.5)
Singapore					552 (6.5)	548 (6.6)
Slovak Republic		▲			509 (6.0)	506 (8.0)
Slovenia					516 (4.4)	509 (6.4)
South Africa					321 (6.3)	339 (9.0)
Thailand					463 (6.7)	461 (6.3)
Tunisia					▲ 448 (6.6)	454 (5.5)
Turkey					452 (8.2)	441 (5.8)
United States					521 (5.4)	523 (6.2)
International Avg.		▲			▲ 489 (1.0)	486 (1.2)

▲ Significantly higher than other gender

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