12

OECD Total and OECD Average

INTRODUCTION

The PISA initial and thematic reports present results for each country and two additional aggregated estimates: the OECD total and the OECD average.

The OECD total considers all the OECD countries as a single entity, to which each country contributes proportionally to the number of 15-year-olds enrolled in its schools. To compute an OECD total estimate, data have to be weighted by the student final weight, *i.e.* W_FSTUWT.

On the contrary, the OECD average does not take into account the absolute size of the population in each country; each country contributes equally to the OECD average. The contribution of the smallest OECD country, *i.e.* Luxembourg, is equivalent to one of the largest countries, *i.e.* the United States.

In the PISA publications, the OECD total is generally used when references are made to the overall situation in the OECD area; the OECD average is used when the focus is on comparing performance across education systems.

In the case of some countries, data may not be available for specific indicators, or specific categories may not apply. Researchers should, therefore, keep in mind that the terms OECD average and OECD total refer to the OECD countries included in the respective comparisons for each cycle and for a particular comparison.

There are two approaches to compute the OECD total and the OECD average.

- One way is to compute them based on the pooled samples of the OECD countries with specific weights. To compute the pooled OECD total estimate, data will be weighted by the student final weight, *i.e.* W_FSTUWT. The computation of the pooled OECD average estimates will require the transformation of the student final weights and replicates so that their sum per country is a constant. These transformed weights are usually denoted as SENAT weights.
- The other way is to compute them directly from the country estimates. The arithmetic OECD total is the weighted average of the country estimates and the arithmetic OECD average is the unweighted average of the country estimates.

The arithmetic OECD total estimate and its respective sampling variance are equal to:

$$\hat{\theta} = \frac{\sum_{i=1}^{C} w_i \hat{\theta}_i}{\sum_{i=1}^{C} w_i} \quad \text{and} \quad SE^2 = \frac{\sum_{i=1}^{C} w_i^2 SE_i^2}{\left[\sum_{i=1}^{C} w_i\right]^2}$$

with θ any statistics, SE^2 its respective sampling variance and w_i being the sum of the student final weights for a particular country, C being the number of OECD countries that participated.

The arithmetic OECD average estimate and its respective sampling variance are equal to:

$$\hat{\theta} = \frac{\sum_{i=1}^{C} \hat{\theta}_i}{C} \quad \text{and} \quad SE^2 = \frac{\sum_{i=1}^{C} SE_i^2}{C^2}$$

with C being the number of OECD countries that participated.

For example, if the statistic is a mean, the arithmetic OECD total mean and its respective sampling variance are equal to:

$$\hat{\mu} = \frac{\sum_{i=1}^{C} w_i \hat{\mu}_i}{\sum_{i=1}^{C} w_i} \text{ and , } \sigma^2_{(\hat{\mu})} = \frac{\sum_{i=1}^{C} w_i^2 \sigma^2_{(\hat{\mu}_i)}}{\left[\sum_{i=1}^{C} w_i\right]^2}$$

with w_i being the sum of the student final weights for a particular country.

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The arithmetic OECD average mean and its respective sampling variance are equal to:

$$\hat{\mu} = \frac{\sum_{i=1}^{C} \hat{\mu}_i}{C} \quad \text{and} \quad \sigma^2_{(\hat{\mu})} = \frac{\sum_{i=1}^{C} \sigma^2_{(\hat{\mu}_i)}}{C^2}$$

with C being the number of OECD countries that participated.

For simple statistics such as a mean or a percentage, the pooled OECD total estimate is mathematically equal to the arithmetic OECD total estimate, and the pooled OECD average estimate is equal to the arithmetic OECD average, respectively, if no data are missing.

If the percentage of missing data varies between countries, however, then these two estimates are not equal anymore, unless a weight adjustment for missing data is applied to W_FSTUWT and SENAT weights. For instance, in PISA 2000, about 60% of the Japanese students did not have information on their parent's main occupation. The data for Japan therefore contribute substantially less than it should for the computation of the pooled OECD average estimate.

Furthermore, "pooled" estimates and "arithmetic" estimates are not equal for the estimates which include the notion of variation (such as standard deviation) and the notion of relationship (such as regression coefficients or correlation). For instance, the pooled OECD average for standard deviation for the student performance, *i.e.* 100, is not equal to the average of country standard deviation. Also the pooled OECD average for a regression coefficient is not equal to the arithmetic OECD average for a regression coefficient and the pooled OECD total for a regression coefficient is not equal to the arithmetic OECD total for a regression coefficient.

Table 12.1

Regression coefficients of the index of instrumental motivation in mathematics on mathematic performance in OECD countries (PISA 2003)

	Change in the mathematics score per unit of this index	
	Effect	S.E.
AUS	16.88	0.91
AUT	-3.70	1.60
BEL	11.03	1.63
CAN	19.78	0.96
CHE	-2.39	1.62
CZE	10.73	1.82
DEU	1.11	1.93
DNK	20.89	1.77
ESP	19.41	1.39
FIN	26.89	1.70
FRA	13.72	1.61
GBR	10.39	1.48
GRC	14.89	1.76
HUN	7.86	1.90
IRL	7.66	1.45
ISL	17.73	1.72
ITA	8.45	1.58
JPN	23.92	2.25
KOR	32.81	1.77
LUX	-0.01	1.35
MEX	5.37	2.44
NLD	6.14	2.00
NOR	28.49	1.49
NZL	15.63	1.81
POL	16.97	1.82
PRT	17.35	2.04
SVK	6.29	1.98
SWE	22.98	2.00
TUR	12.89	2.39
USA	13.58	1.52
Pooled OECD average	**8.52**	**0.41**
Arithmetic OECD average	**13.46**	**0.32**

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The example presented in Table 12.1, which presents the mathematic score per unit of the index of instrumental motivation in mathematics in PISA 2003, illustrates the distinction between the pooled OECD average and the arithmetic OECD average. The arithmetic OECD average for a regression coefficient, *i.e.* the average of the country regression coefficients, differs from the pooled OECD average in Table 12.1

In the PISA 2000 and 2003 initial and thematic reports published before 2005, the pooled OECD total and the pooled OECD average were reported as the OECD total and the OECD average. In the PISA publication after 2005, in general, the OECD total corresponds to the pooled OECD total, while the OECD average corresponds to the arithmetic OECD average, unless otherwise stated.

RECODING OF THE DATABASE TO ESTIMATE THE POOLED OECD TOTAL AND THE POOLED OECD AVERAGE

As stated in Chapter 4, the sum of the student final weights per country is an estimate of the 15-year-old population in that country. Therefore, the OECD total statistic can easily be obtained by deleting the partner country data. Then the statistic is computed, without using the country breakdown variable (CNT). The standard error is obtained as usual by using the 80 replicates. Box 12.1 provides the SPSS® syntax for computing the pooled OECD total for the mathematics performance by gender in PISA 2003 and Table 12.2 provides the results of the procedure.

Box 12.1 **SPSS® syntax for computing the pooled OECD total for the mathematics performance by gender (*e.g.* PISA 2003)**

```
GET FILE="C:\PISA\2003\DATA\INT_STUI_2003.SAV".

SELECT IF (
CNT="AUS"|CNT="AUT"|CNT="BEL"|CNT="CAN"|CNT="CHE"|CNT="CZE"|
CNT="DEU"|CNT="DNK"|CNT="ESP"|CNT="FIN"|CNT="FRA"|CNT="GBR"|
CNT="GRC"|CNT="HUN"|CNT="ISL"|CNT="IRL"|CNT="ITA"|CNT="JPN"|
CNT="KOR"|CNT="LUX"|CNT="MEX"|CNT="NLD"|CNT="NZL"|CNT="NOR"|
CNT="POL"|CNT="PRT"|CNT="SVK"|CNT="SWE"|CNT="TUR"|CNT="USA").
SELECT IF (ST03Q01=1|ST03Q01=2).
SAVE OUTFILE="C:\TEMP\OECD2003.SAV".

INSERT FILE="C:\PISA\MACRO\MCR_SE_PV.SPS".

SET PRINT=YES.

PV   STAT=MEAN/
     DEP=PV1MATH PV2MATH PV3MATH PV4MATH PV5MATH/
     INFILE="C:\TEMP\OECD2003.SAV"/
     GRP=ST03Q01/.
```

Table 12.2
Output data file from Box 12.1

ST03Q01	Statistics	STAT	SE
1	MEAN	483.93	1.25
2	MEAN	494.04	1.32

Computing the pooled OECD average requires an additional step. The student final weights need to be recoded, so that the sum of the student final weights per country is equal to a constant, *e.g.* 1 000. This can easily be implemented, as described in Box 12.2. Table 12.3 presents the results of the procedure.

Box 12.2 SPSS® syntax for the pooled OECD average for the mathematics performance by gender (*e.g.* PISA 2003)

```
GET FILE="C:\PISA\2003\DATA\INT_STUI_2003.SAV".

SELECT IF (
CNT="AUS"|CNT="AUT"|CNT="BEL"|CNT="CAN"|CNT="CHE"|CNT="CZE"|
CNT="DEU"|CNT="DNK"|CNT="ESP"|CNT="FIN"|CNT="FRA"|CNT="GBR"|
CNT="GRC"|CNT="HUN"|CNT="ISL"|CNT="IRL"|CNT="ITA"|CNT="JPN"|
CNT="KOR"|CNT="LUX"|CNT="MEX"|CNT="NLD"|CNT="NZL"|CNT="NOR"|
CNT="POL"|CNT="PRT"|CNT="SVK"|CNT="SWE"|CNT="TUR"|CNT="USA").
SAVE OUTFILE="C:\TEMP\OECD2003a.SAV".

SORT CASES BY CNT(A) SCHOOLID(A) STIDSTD(A).
WEIGHT OFF.

AGGREGATE
  /OUTFILE=* MODE=ADDVARIABLES
  /BREAK=CNT
  /WGTSUM=SUM(W_FSTUWT).

COMPUTE W_FSTUWT=(W_FSTUWT/WGTSUM)*1000.
DO REPEAT  a= W_FSTR1 to W_FSTR80.
COMPUTE a=(a/WGTSUM)*1000.
END REPEAT.
SELECT IF (ST03Q01=1|ST03Q01=2).
SAVE OUTFILE="C:\TEMP\OECD2003a.SAV".

SET MPRINT=YES.
PV   STAT=MEAN/
     DEP=PV1MATH PV2MATH PV3MATH PV4MATH PV5MATH/
     INFILE="C:\TEMP\OECD2003a.SAV"/
     GRP=ST03Q01/.
```

It is worth noting that the standard error is higher for the pooled OECD total than it is for the pooled OECD average. In the case of the pooled OECD total, 40% of the data come from just two countries (*i.e.* Japan and the United States), and these two countries do not have large sample sizes compared to the other OECD countries.

Table 12.3
Output data file from Box 12.2

ST03Q01	Statistics	STAT	SESTAT
1	MEAN	494.41	0.76
2	MEAN	505.53	0.75

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DUPLICATION OF THE DATA TO AVOID RUNNING THE PROCEDURE THREE TIMES

If a researcher is interested in the country estimates as well as the pooled OECD total and the pooled OECD average, then three runs of the procedure are needed: one for the country estimates, one for the pooled OECD total estimate and one for the pooled OECD average estimate.

Box 12.3 SPSS® syntax for the creation of a larger dataset that will allow the computation of the pooled OECD total and the pooled OECD average in one run (*e.g.* PISA 2003)

```
GET FILE="C:\PISA\2003\DATA\INT_STUI_2003.SAV".
COMPUTE ORDRE=4.
IF (CNT="AUS"| CNT="AUT"| CNT="BEL"| CNT="CAN"| CNT="CHE" | CNT="CZE"|
CNT="DEU"| CNT="DNK"| CNT="ESP"| CNT="FIN"| CNT="FRA"| CNT="GBR" |
CNT="GRC"| CNT="HUN"| CNT="ISL"| CNT="IRL"| CNT="ITA"| CNT="JPN"|
CNT="KOR"| CNT="LUX"| CNT="MEX"| CNT="NLD"| CNT="NZL"| CNT="NOR"|
CNT="POL"| CNT="PRT"| CNT="SVK"| CNT="SWE"| CNT="TUR"| CNT="USA") ORDRE=1.
STRING PAYS (A3).
COMPUTE PAYS=CNT.
SORT CASES BY ORDRE(A) PAYS(A) .
SAVE OUTFILE="C:\TEMP\TEMP1.SAV".
GET FILE="C:\PISA\2003\DATA\INT_STUI_2003.SAV".
SELECT IF
(CNT="AUS"| CNT="AUT"| CNT="BEL"| CNT="CAN"| CNT="CHE"| CNT="CZE"|
 CNT="DEU"| CNT="DNK"| CNT="ESP"| CNT="FIN"| CNT="FRA"| CNT="GBR"|
 CNT="GRC"| CNT="HUN"| CNT="ISL"| CNT="IRL"| CNT="ITA"| CNT="JPN"|
 CNT="KOR"| CNT="LUX"| CNT="MEX"| CNT="NLD"| CNT="NZL"| CNT="NOR"|
 CNT="POL"| CNT="PRT"| CNT="SVK"| CNT="SWE"| CNT="TUR"| CNT="USA").
COMPUTE ORDRE=2.
STRING PAYS (A3).
COMPUTE PAYS="TOT".
SORT CASES BY ORDRE(A) PAYS(A) .
SAVE OUTFILE="C:\TEMP\TEMP2.SAV".
GET FILE="C:\PISA\2003\DATA\INT_STUI_2003.SAV".
SELECT IF
(CNT="AUS"| CNT="AUT"| CNT="BEL"| CNT="CAN"| CNT="CHE"| CNT="CZE"|
 CNT="DEU"| CNT="DNK"| CNT="ESP"| CNT="FIN"| CNT="FRA"| CNT="GBR"|
 CNT="GRC"| CNT="HUN"| CNT="ISL"| CNT="IRL"| CNT="ITA"| CNT="JPN"|
 CNT="KOR"| CNT="LUX"| CNT="MEX"| CNT="NLD"| CNT="NZL"| CNT="NOR"|
 CNT="POL"| CNT="PRT"| CNT="SVK"| CNT="SWE"| CNT="TUR"| CNT="USA").
COMPUTE ORDRE=3.
STRING PAYS (A3).
COMPUTE PAYS="AVE".
SORT CASES BY ORDRE(A) PAYS(A) .
WEIGHT OFF.
AGGREGATE
  /OUTFILE=* MODE=ADDVARIABLES
  /BREAK=ORDRE CNT
  /WGTSUM=SUM(W_FSTUWT).
COMPUTE W_FSTUWT=(W_FSTUWT/WGTSUM)*1000.
DO REPEAT  a= W_FSTR1 to W_FSTR80.
COMPUTE a=(a/WGTSUM)*1000.
END REPEAT.
SAVE OUTFILE="C:\TEMP\TEMP3.SAV" /DROP=WGTSUM.
ADD FILES
FILE="C:\TEMP\TEMP1.SAV"
FILE="C:\TEMP\TEMP2.SAV"
FILE="C:\TEMP\TEMP3.SAV".
SORT CASES BY ORDRE(A) PAYS(A) CNT(A) SCHOOLID(A) STIDSTD(A).
SAVE OUTFILE="C:\TEMP\FUSION.SAV".
```


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In order to avoid such repetitions, it is possible to duplicate three times the data for the OECD countries in such a way that the procedure directly provides the estimates for each country, as well as the pooled OECD total and the pooled OECD average estimates.

Box 12.3 presents the SPSS® syntax for the generation of such datasets. It consists of the following steps:

- Create a file (TEMP1.SAV) with a new categorical variable, denoted ORDRE, which separates OECD and the partner countries; a value of 1 for OECD countries, a value of 4 for the partner countries. Also, create an alphanumerical variable, denoted PAYS, and set it as CNT.
- Create a file (TEMP2.SAV) by selecting only OECD countries, set the variable OECD as 2, set the PAYS variable as TOT.
- Create a file (TEMP3.SAV) by selecting only the OECD countries. Add within this file the sum of the weight per country and transform the final student weights in such a way that the sum per country is equal to 1 000. Apply the same linear transformation to the 80 replicates. Set the PAYS variable as AVE and the OECD variable as 3.
- Merge the three files and then save these new data into a new data file.

SPSS® macros presented in the previous chapters can be applied to this new data file. The breakdown variables are now ORDRE and PAYS. The output data file will contain two additional rows for the pooled OECD average and the pooled OECD total. The first 30 rows will be the results of OECD countries. The next two rows will present the pooled OECD total and the pooled OECD average estimates. Finally, the last rows will present the estimates for the partner countries.

With the increasing numbers of partner countries and of countries that are oversampling for subnational adjudication, the file with duplicates might contain more than 500 000 records. In terms of computing time, this procedure might become less efficient than estimating separately the pooled OECD total and the pooled OECD average. However, creating a file with duplicates might be required if the difference between an OECD country and the pooled OECD total or the pooled OECD average need to be statistically tested.

COMPARISONS BETWEEN THE POOLED OECD TOTAL OR POOLED OECD AVERAGE ESTIMATES AND A COUNTRY ESTIMATE

As a reminder, only OECD countries that are fully adjudicated contribute to the OECD average and the OECD total estimates and their respective standard errors. Therefore, the expected value of the covariance between a country sampling variance and the OECD aggregate sampling variance will differ from 0 if the country's values are included in the OECD aggregate values, because the two are not independent. Indeed, if the sampling variance of one country increases, then the OECD aggregate sampling variance will also increase.

If a researcher wants to test the null hypothesis between an OECD country and the OECD aggregate estimate, then the covariance should be estimated, as explained in Chapter 11. Since the covariance is expected to be positive, then the correct standard error estimate should be smaller than the standard error obtained from the formulae.

Since partner countries do not contribute at all to the OECD aggregate estimates, estimating the covariance is not necessary. The standard error on the difference can be directly obtained from the country standard error and the aggregate standard error.

Table 12.4 provides:

- the country mean performance in mathematics as well as the pooled OECD total and the pooled OECD average in PISA 2003;
- the standard error on these mean estimates;
- the difference between the country mean and the pooled OECD total;
- the standard error on this difference, using the formula provided in Chapter 10, *i.e.* without an estimation of the covariance;
- the standard error on this difference, using the replicates, *i.e.* with an estimation of the covariance;
- the difference between the country mean and the pooled OECD average;
- the standard error on this difference, using the formula provided in Chapter 10, *i.e.* without an estimation of the covariance;
- the standard error on this difference, using the replicates, *i.e.* with an estimation of the covariance.

Table 12.4

Difference between the country mean scores in mathematics and the OECD total and average (PISA 2003)

		Mean score		Difference from the OECD total			Difference from the OECD average		
		Mean	S.E.	Dif.	S.E. without the covariance estimates	S.E. with the covariance estimates	Dif.	S.E. without the covariance estimates	S.E. with the covariance estimates
OECD	Australia	524	2.2	35	2.4	**2.1**	24	2.2	**2.0**
	Austria	506	3.3	17	3.4	**3.5**	6	3.3	**3.3**
	Belgium	529	2.3	40	2.5	**2.4**	29	2.4	**2.2**
	Canada	532	1.8	43	2.1	**2.1**	32	1.9	**2.0**
	Czech Republic	516	3.6	27	3.7	**3.9**	16	3.6	**3.5**
	Denmark	514	2.7	25	3.0	**3.0**	14	2.8	**2.7**
	Finland	544	1.9	55	2.2	**2.1**	44	2.0	**1.9**
	France	511	2.5	22	2.7	**2.5**	11	2.6	**2.5**
	Germany	503	3.3	14	3.5	**3.4**	3	3.4	**3.3**
	Greece	445	3.9	-44	4.1	**3.9**	-55	4.0	**3.8**
	Hungary	490	2.8	1	3.0	**3.2**	-10	2.9	**3.0**
	Iceland	515	1.4	26	1.8	**1.8**	15	1.6	**1.5**
	Ireland	503	2.5	14	2.7	**2.6**	3	2.5	**2.4**
	Italy	466	3.1	-23	3.3	**3.1**	-34	3.1	**3.0**
	Japan	534	4.0	45	4.2	**3.9**	34	4.1	**3.9**
	Korea	542	3.2	53	3.4	**3.3**	42	3.3	**3.2**
	Luxembourg	493	1.0	4	1.5	**1.5**	-7	1.2	**1.2**
	Mexico	385	3.6	-104	3.8	**3.6**	-115	3.7	**3.6**
	Netherlands	538	3.1	49	3.3	**3.2**	38	3.2	**3.1**
	New Zealand	523	2.3	34	2.5	**2.4**	23	2.3	**2.3**
	Norway	495	2.4	6	2.6	**2.7**	-5	2.5	**2.4**
	Poland	490	2.5	1	2.7	**2.8**	-10	2.6	**2.5**
	Portugal	466	3.4	-23	3.6	**3.3**	-34	3.5	**3.2**
	Slovak Republic	498	3.4	9	3.5	**3.5**	-2	3.4	**3.3**
	Spain	485	2.4	-4	2.6	**2.6**	-15	2.5	**2.5**
	Sweden	509	2.6	20	2.8	**2.5**	9	2.6	**2.4**
	Switzerland	527	3.4	38	3.6	**3.5**	27	3.4	**3.4**
	Turkey	423	6.7	-66	6.8	**6.5**	-77	6.8	**6.5**
	United Kingdom	508	2.4	19	2.7	**2.4**	8	2.5	**2.4**
	United States	483	3.0	-6	3.1	**2.4**	-17	3.0	**2.9**
	OECD total	**489**	**1.1**						
	OECD average	**500**	**0.6**						
Partners	Brazil	356	4.8	-133	**5.0**	4.9	-144	**4.9**	4.8
	Hong Kong-China	550	4.5	61	**4.7**	4.8	50	**4.6**	4.7
	Indonesia	360	3.9	-129	**4.1**	4.0	-140	**4.0**	3.9
	Latvia	483	3.7	-6	**3.8**	3.9	-17	**3.7**	3.8
	Liechtenstein	536	4.1	47	**4.3**	4.2	36	**4.2**	4.1
	Macao-China	527	2.9	38	**3.1**	3.1	27	**3.0**	2.9
	Russian Federation	468	4.2	-21	**4.3**	4.5	-32	**4.2**	4.3
	Serbia	437	3.8	-52	**3.9**	3.9	-63	**3.8**	3.8
	Thailand	417	3.0	-72	**3.2**	3.4	-83	**3.1**	3.2
	Tunisia	359	2.5	-130	**2.8**	2.6	-141	**2.6**	2.6
	Uruguay	422	3.3	-67	**3.5**	3.4	-78	**3.4**	3.3

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The correct standard error estimates are in bold in Table 12.4. The differences between the biased and unbiased estimates for OECD countries are not very large.

The differences for partner countries are not very large either. As the expected covariance for partner countries are 0, both standard errors are on average unbiased. However, it is recommended to use the standard error directly obtained with the formula.

COMPARISONS BETWEEN THE ARITHMETIC OECD TOTAL OR ARITHMETIC OECD AVERAGE ESTIMATES AND A COUNTRY ESTIMATE

The standard error on a difference between the arithmetic OECD total and an OECD country estimate can be mathematically computed as follows:[1]

$$SE^2_{(OECD\_TOT-J)} = \frac{\sum_{i=1}^{C} w_i^2 SE_i^2 + \left[\left(\sum_{i=1}^{C} w_i - w_j\right)^2 - w_j^2\right] SE_j^2}{\left[\sum_{i=1}^{C} w_i\right]^2}$$

with C being the number of OECD countries, SE_j being the standard error for country j θ parameter estimate, w_i being the sum of the student final weights for a particular country i and w_j being the sum of the student final weights for a particular country j.

In this formula, it can be observed that the first block on the right side of the equation, *i.e.* $\frac{\sum_{i=1}^{C} w_i^2 SE_i^2}{\left[\sum_{i=1}^{C} w_i\right]^2}$, is equivalent to the equation for the sampling variance for the arithmetic OECD total presented at the beginning of this chapter.

The standard error on a difference between the arithmetic OECD average and an OECD country estimate can be mathematically computed as follows (Gonzalez, 2003):

$$SE^2_{(OECD\_AV-J)} = \frac{\sum_{i=1}^{C} SE_i^2 + \left[(C-1)^2 - 1\right] SE_j^2}{C^2}$$

with C being the number of OECD countries and SE_j being the standard error for country j θ parameter estimate.

In this formula, it can be observed that the first block on the right side of the equation, *i.e.* $\frac{\sum_{i=1}^{C} SE_i^2}{C^2}$, is equivalent to the equation for the sampling variance for the arithmetic OECD average presented at the beginning of this chapter.

CONCLUSION

This chapter discussed the concepts of OECD total and OECD average. First, the pooled OECD total and the arithmetic OECD total as well as the pooled OECD average and the arithmetic OECD average were introduced. The "pooled" and "arithmetic" estimates should be the same, as far as no data are missing, for the simple statistics such as mean and percentage, but these are different for the statistics which involves the notion of variation or relationship (*e.g.* standard deviation and correlation coefficient).

The second section presented the recoding of the database in order to estimate the pooled OECD total and the pooled OECD average. The SPSS® syntax for creating a larger dataset was also provided.

Finally, following the issues raised in the previous chapter devoted to comparisons, any comparison that involves a particular country and an OECD aggregate estimate was discussed.

Note

1. The derivation assumes that the population size is known, which is not the case in PISA. However, this variance is a "second order" contribution to the standard error that it is estimating and can therefore be ignored.

References

Beaton, A.E. (1987), *The NAEP 1983-1984 Technical Report*, Educational Testing Service, Princeton.

Beaton, A.E., *et al.* (1996), *Mathematics Achievement in the Middle School Years, IEA's Third International Mathematics and Science Study*, Boston College, Chestnut Hill, MA.

Bloom, B.S. (1979), *Caractéristiques individuelles et apprentissage scolaire*, Éditions Labor, Brussels.

Bressoux, P. (2008), *Modélisation statistique appliquée aux sciences sociales*, De Boek, Brussels.

Bryk, A.S. and **S.W. Raudenbush** (1992), *Hierarchical Linear Models for Social and Behavioural Research: Applications and Data Analysis Methods*, Sage Publications, Newbury Park, CA.

Buchmann, C. (2000), *Family structure, parental perceptions and child labor in Kenya: What factors determine who is enrolled in school?* a*Soc. Forces*, No. 78, pp. 1349-79.

Cochran, W.G. (1977), *Sampling Techniques*, J. Wiley and Sons, Inc., New York.

Dunn, O.J. (1961), "Multilple Comparisons among Menas", *Journal of the American Statistical Association*, Vol. 56, American Statistical Association, Alexandria, pp. 52-64.

Kish, L. (1995), *Survey Sampling*, J. Wiley and Sons, Inc., New York.

Knighton, T. and **P. Bussière** (2006), "Educational Outcomes at Age 19 Associated with Reading Ability at Age 15", Statistics Canada, Ottawa.

Gonzalez, E. and **A. Kennedy** (2003), *PIRLS 2001 User Guide for the International Database*, Boston College, Chestnut Hill, MA.

Ganzeboom, H.B.G., P.M. De Graaf and **D.J. Treiman** (1992), "A Standard International Socio-economic Index of Occupation Status", *Social Science Research* 21(1), Elsevier Ltd, pp 1-56.

Goldstein, H. (1995), *Multilevel Statistical Models*, 2nd Edition, Edward Arnold, London.

Goldstein, H. (1997), "Methods in School Effectiveness Research", *School Effectiveness and School Improvement* 8, Swets and Zeitlinger, Lisse, Netherlands, pp. 369-395.

Hubin, J.P. (ed.) (2007), *Les indicateurs de l'enseignement*, 2nd Edition, Ministère de la Communauté française, Brussels.

Husen, T. (1967), *International Study of Achievement in Mathematics: A Comparison of Twelve Countries*, Almqvist and Wiksells, Uppsala.

International Labour Organisation (ILO) (1990), *International Standard Classification of Occupations: ISCO-88.* Geneva: International Labour Office.

Lafontaine, D. and **C. Monseur** (forthcoming), "Impact of Test Characteristics on Gender Equity Indicators in the Assessment of Reading Comprehension", *European Educational Research Journal*, Special Issue on PISA and Gender.

Lietz, P. (2006), "A Meta-Analysis of Gender Differences in Reading Achievement at the Secondary Level", *Studies in Educational Evaluation* 32, pp. 317-344.

Monseur, C. and **M. Crahay** (forthcoming), "Composition académique et sociale des établissements, efficacité et inégalités scolaires : une comparaison internationale – Analyse secondaire des données PISA 2006", *Revue française de pédagogie.*

OECD (1998), *Education at a Glance – OECD Indicators*, OECD, Paris.

OECD (1999a), *Measuring Student Knowledge and Skills – A New Framework for Assessment*, OECD, Paris.

OECD (1999b), *Classifying Educational Programmes – Manual for ISCED-97 Implementation in OECD Countries*, OECD, Paris.

OECD (2001), *Knowledge and Skills for Life – First Results from PISA 2000*, OECD, Paris.

OECD (2002a), *Programme for International Student Assessment – Manual for the PISA 2000 Database*, OECD, Paris.

OECD (2002b), *Sample Tasks from the PISA 2000 Assessment – Reading, Mathematical and Scientific Literacy,* OECD, Paris.

OECD (2002c), *Programme for International Student Assessment – PISA 2000 Technical Report,* OECD, Paris.

OECD (2002d), *Reading for Change: Performance and Engagement across Countries – Results from PISA 2000,* OECD, Paris.

OECD (2003a), *Literacy Skills for the World of Tomorrow – Further Results from PISA 2000,* OECD, Paris.

OECD (2003b), *The PISA 2003 Assessment Framework – Mathematics, Reading, Science and Problem Solving Knowledge and Skills,* OECD, Paris.

OECD (2004a), *Learning for Tomorrow's World – First Results from PISA 2003,* OECD, Paris.

OECD (2004b), *Problem Solving for Tomorrow's World – First Measures of Cross-Curricular Competencies from PISA 2003,* OECD, Paris.

OECD (2005a), *PISA 2003 Technical Report,* OECD, Paris.

OECD (2005b), *PISA 2003 Data Analysis Manual,* OECD, Paris.

OECD (2006), *Assessing Scientific, Reading and Mathematical Literacy: A Framework for PISA 2006,* OECD, Paris.

OECD (2007), *PISA 2006: Science Competencies for Tomorrow's World,* OECD, Paris.

OECD (2009), *PISA 2006 Technical Report,* OECD, Paris.

Peaker, G.F. (1975), *An Empirical Study of Education in Twenty-One Countries: A Technical report. International Studies in Evaluation VIII,* Wiley, New York and Almqvist and Wiksell, Stockholm.

Rust, K.F. and **J.N.K. Rao** (1996), "Variance Estimation for Complex Surveys Using Replication Techniques", *Statistical Methods in Medical Research,* Vol. 5, Hodder Arnold, London, pp. 283-310.

Rutter, M., *et al.* (2004), "Gender Differences in Reading Difficulties: Findings from Four Epidemiology Studies", *Journal of the American Medical Association* 291, pp. 2007-2012.

Schulz, W. (2006), *Measuring the socio-economic background of students and its effect on achievement in PISA 2000 and PISA 2003,* Paper presented at the Annual Meetings of the American Educational Research Association (AERA) in San Francisco, 7-11 April.

Wagemaker, H. (1996), *Are Girls Better Readers. Gender Differences in Reading Literacy in 32 Countries,* IEA, The Hague.

Warm, T.A. (1989), "Weighted Likelihood Estimation of Ability in Item Response Theory", *Psychometrika,* Vol. 54(3), Psychometric Society, Williamsburg, VA., pp. 427-450.

Wright, B.D. and **M.H. Stone** (1979), *Best Test Design: Rasch Measurement,* MESA Press, Chicago.

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User's Guide

Preparation of data files

All data files (in text format) and the SPSS® control files are available on the PISA website (*www.pisa.oecd.org*).

SPSS® users

By running the SPSS® control files, the PISA data files are created in the SPSS® format. Before starting analysis in the following chapters, save the PISA 2000 data files in the folder of "c:\pisa2000\data\", the PISA 2003 data files in "c:\pisa2003\data\", and the PISA 2006 data files in "c:\pisa2006\data\".

SPSS® syntax and macros

All syntaxes and macros in this manual can be copied from the PISA website (*www.pisa.oecd.org*). These macros were developed for SPSS 17.0. The 19 SPSS® macros presented in Chapter 17 need to be saved under "c:\pisa\macro\", before staring analysis. Each chapter of the manual contains a complete set of syntaxes, which must be done sequentially, for all of them to run correctly, within the chapter.

Rounding of figures

In the tables and formulas, figures were rounded to a convenient number of decimal places, although calculations were always made with the full number of decimal places.

Country abbreviations used in this manual

AUS	Australia	FRA	France	MEX	Mexico
AUT	Austria	GBR	United Kingdom	NLD	Netherlands
BEL	Belgium	GRC	Greece	NOR	Norway
CAN	Canada	HUN	Hungary	NZL	New Zealand
CHE	Switzerland	IRL	Ireland	POL	Poland
CZE	Czech Republic	ISL	Iceland	PRT	Portugal
DEU	Germany	ITA	Italy	SVK	Slovak Republic
DNK	Denmark	JPN	Japan	SWE	Sweden
ESP	Spain	KOR	Korea	TUR	Turkey
FIN	Finland	LUX	Luxembourg	USA	United States

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