

## EDUCATIONAL ATTAINMENT IN THE OECD, 1960-2010

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### **Abstract**

This paper describes the construction of series of educational attainment of the adult population in a sample of 21 OECD countries covering the period 1960-2010. These series are a revised version of the data set described in de la Fuente and Doménech (2002)

## **1. Introduction**

This document describes the construction of series on the educational attainment of the adult population for a sample of 21 OECD countries covering the period 1960-2010. These series are a revised and extended version of the data set described in de la Fuente and Doménech (2002 and 2006).

There are two major changes relative to our earlier estimates of schooling levels. First, we have extended the series from 1990 or 1995 to 2010. Second, we have incorporated a fair amount of new information taken mostly from the websites of national statistical institutes. Our new series rely almost exclusively on national sources. To the extent possible, we have avoided the use of compilations produced by UNESCO and other international organizations whose attempts to homogenize the data may be counterproductive on occasion.

The rest of the paper is divided into two sections and an appendix. Section 2 outlines the methodology used in the construction of the series and provides some summary information on the availability of primary data. Section 3 contains the series themselves, which are also included for convenience in a separate Excel file. Finally, the Appendix describes in detail the construction of the attainment series for each country and the sources used in each case.

## **2. Description of the series and notes on their construction**

Our overall strategy for the construction of long series on educational attainment has been the same as in our previous paper: we have collected all the information we could find on the educational attainment of the adult population (aged 25 and over) in the countries of interest and used our best judgment to try to construct a plausible time series for each one of them. To the extent possible, we have relied on national sources (census and survey results, data drawn from educational registers and information provided directly by national statistical agencies) but we have also made occasional use of information taken from international compilations produced by UNESCO and other international organizations to fill in certain gaps in the data.

For most countries, reasonably complete educational data for recent years can be found on their National Statistical Institute's website. In many cases, this source provides a fairly detailed breakdown by age group that can be exploited to construct backward projections for earlier years. After exploiting these data, we have generally worked backwards in time drawing on whatever other sources were available and trying to avoid unreasonable jumps in the series by choosing the most plausible figure when several were available for the same year, and by reinterpreting some of the data (as referring to broader or narrower schooling categories than the reported one) when it seemed sensible to do so. Missing observations were then filled in a variety of ways. Where possible, we interpolated between

available observations. Otherwise, we have relied on miscellaneous information from a variety of sources in order to construct plausible estimates of attainment levels. We have avoided the use of flow estimates based on enrollment data because they seem to produce implausible time profiles, but we have made occasional use of enrollment data to complement other sources.

Clearly, the construction of our series involves a fair amount of guesswork. Our methodology looks decidedly less scientific than the apparently more systematic estimation procedures used by other authors starting from supposedly homogeneous data produced by UNESCO and other international organizations (see for instance Barro and Lee, 1996 and 2010, and Cohen and Soto, 2007). However, even a cursory examination of the data shows that there is no such homogeneity (see de la Fuente and Doménech, 2006). Hence, we have found it preferable to rely on judgment to try to piece together the available information in a coherent manner than to take for granted the accuracy of the primary data. As we show in a companion piece to this paper, the results do look more plausible than most existing series, at least in terms of their time profile, and perform rather well in terms of a statistical indicator of data quality.

### 2.1. Attainment categories and average durations

We aim to provide estimates of the fraction of the population aged 25 and over (for short, population 25+ from now on) that has attained each of the levels of education shown in Table 1: illiterates ( $L0$ ), primary schooling ( $L1$ ), lower and upper secondary schooling ( $L2.1$  and  $L2.2$ ) and two levels of higher education ( $L3.1$  and  $L3.2$ ). Whenever possible, we break down upper secondary schooling attainment into an academic and a vocational component ( $L2.2ac$  and  $L2.2voc$ ). We have tried (with uncertain success) to include upper-level vocational courses (ISCED 5 studies according to the international standard classification of educational attainment levels) in the first level of higher attainment,  $L3.1$ . We report  $L0$  only for the four countries where illiteracy rates are significant during most of the sample period (Portugal, Greece, Spain and Italy). For the rest of the sample, the lowest reported category is  $L1$ , and it includes all those who have not reached secondary school.

**Table 1: Attainment levels and codes**

<i>code</i>	<i>level</i>
$L0$	Illiterates
$L1$	Primary schooling
$L2.1$	Lower secondary schooling
$L2.2$	Upper secondary schooling
$L2$	Total secondary schooling = $L2.1 + L2.2$
$L3.1$	Higher education, first cycle or short post-secondary courses
$L3.2$	Higher education, second cycle or full-length courses
$L3$	Total higher education = $L3.1 + L3.2$

Depending on the country, attainment rates may reflect either the fraction of the population that has started each educational level or those who have completed it successfully (which in some cases requires a passing grade on an exit examination). Table 2 lists the attainment concepts used in each country for the different schooling levels. With the exception of  $L1$ , which generally includes those

with incomplete primary education or no formal studies, the data available for calculating attainment rates tend to be based on a completion criterion, but there are numerous exceptions for which such data are not available. Hence, our estimates of attainment rates are not fully comparable across countries. On the other hand, they are generally consistent over time within each given country. While we have detected a few instances of countries that have switched from one criterion to the other, these changes do not seem to generate significant breaks in the series, suggesting perhaps that completion rates were close to 100% in the affected levels and countries.

**Table 2: Attainment measures: started (s) vs. completed (c)**

	<i>L1</i>	<i>L2.1</i>	<i>L2.2</i>	<i>L2.2ac</i>	<i>L2.2voc</i>	<i>L3.1</i>	<i>L3.2</i>
<i>Australia</i>	s	s		s	c	c	c
<i>Austria</i>	s	s <sup>a</sup>		c	c	c	c
<i>Belgium</i>	s	s	c			c	c
<i>Canada</i>	s	s	s			s	c
<i>Denmark</i>	s	c		c	c	c	c
<i>Finland</i>	s	c	c			c	c
<i>France</i>	s	s		s	s	s	s
<i>Germany</i>	s	c		c	c	c	c
<i>Greece</i>	s	c	c			c <sup>b</sup>	c
<i>Ireland<sup>c</sup></i>	s	c	c			c	c
<i>Italy</i>	s	c	c				c
<i>Japan<sup>d</sup></i>	s	c	c			c	c
<i>Netherlands<sup>e</sup></i>	s	c	c			c	c
<i>New Zealand</i>	s	c	c			c	c
<i>Norway</i>	s	s <sup>a</sup>	c			c	c
<i>Portugal<sup>f</sup></i>	s	s	s			s	s
<i>Spain</i>	s	c	c	c	c	c	c
<i>Sweden</i>	s	s	s			s	s
<i>Switzerland<sup>g</sup></i>	s	c	c			c	c
<i>UK</i>	s	c	c			c	c
<i>USA</i>	s	s	s			s	s

Notes:

(a) original data mostly refer to *L1+L2.1* rather than to *L2.1* per se.

(b) includes those over 25 currently enrolled in a university, TEI or intermediate school.

(c) Data refer mostly to completed degrees for 1991 onward; in earlier years, they refer to the highest level started but not necessarily completed. See the detailed country notes in the Appendix.

(d) Includes those over 25 who are currently enrolled in each level (insignificant except for university).

(e) Refers to LFS data for 2001 onward. For earlier years, we are not sure.

(f) For 1981 onward, for earlier years we don't know.

(g) For LFS data for 2000 onward. For earlier years we are not sure but it seems likely the criterion has not changed, as there are no apparent breaks in the series.

Using our attainment series, we construct an estimate of the average years of total schooling for each country and period. Table 3 shows the cumulative durations of the different school cycles in each country that have been used for this calculation. These durations come mostly from the same national sources as our attainment data and correspond to the cutoff points we have used to identify the different schooling levels --even when these cutoffs are imposed by data availability and do not coincide exactly with the theoretical boundaries between different educational cycles. For example, in Canada primary school lasts for 5 or 6 years depending on the province but since the only data we have to approximate primary attainment refers to those who have completed 4 or less courses, we will

assign a duration of 4 years to *L1* for purposes of calculating average attainment. Something similar happens in the case of the USA.

**Table 3: Cumulative years of schooling by educational level**

	<i>L1</i>	<i>L2.1</i>	<i>L2.2</i>	<i>L3.1</i>	<i>L3.2</i>
<i>Australia</i>	6	10	12	14	16
<i>Austria</i>	4	8	12	15	17
<i>Belgium</i>	6	9	12	15	16
<i>Canada</i>	4	8	12	14	16
<i>Denmark</i>	6	9	12	14	17
<i>Finland</i>	6	9	12	15	17
<i>France</i>	5	9	12	14	17
<i>Germany</i>	4	10	12	14	16
<i>Greece</i>	6	9	12	14	16
<i>Ireland</i>	6	9	12	14	16
<i>Italy</i>	5	8	13	-	18
<i>Japan</i>	6	9	12	14	16
<i>Netherlands</i>	6	10	12	15	17
<i>New Zealand</i>	7	10	12	14	16
<i>Norway</i>	7	10	13	15	18
<i>Portugal</i>	6	9	12	15	17
<i>Spain</i>	6	10	12	14	17
<i>Sweden</i>	7	10	13	15	17
<i>Switzerland</i>	8	9	12	14	17
<i>UK</i>	5	10	12	15	17
<i>USA</i>	4	8	12	14	16
<i>Mode</i>	6	9	12	14	16

Since these durations are applied to all countries without any correction, our estimates of average schooling will be biased upward in those cases where attainment shares are not based on completed studies. For the same reason, our figures may not always be strictly comparable with Barro and Lee's (1996 or 2010) average schooling series, which in principle apply a uniform completion criterion across countries. On the other hand, we are not sure of the quality of the supposedly homogenized attainment data used by these authors. Since the underlying information is presumably the same in both cases, it seems likely that Barro and Lee's data—and that constructed by other authors—will also contain some noise arising from cross-country differences in how attainment is measured.

## 2.2. Backward and forward projections

As noted above, in a number of countries we rely on backward projections of census data disaggregated by age group in order to estimate attainment shares in the early part of the sample period. The procedure we use is essentially the one developed by Cohen and Soto (2007), as refined by Barro and Lee (2010) in order to (partially) allow for differences in survival rates across population subgroups with different levels of educational attainment.

The basic idea is extremely simple. Let  $h_{jt}^a$  denote the share of the population of age group  $a$  that has attained educational level  $j$  at time  $t$ . If we assume that individual school attainment does not change over time once agents reach the age of 25 (which is probably a rather good approximation), that there

are no migration flows (or that migrants have the same educational level as the rest of the population) and that survival probabilities are independent of educational attainment, then the mean educational level of a given 25+ cohort remains constant over time. Under these assumptions, in particular, the attainment shares of a given cohort (say cohort  $a$  at time  $t$ ) can be simply moved back over time to  $t-5$  (at which time it constituted age group  $a-1$ ) so that we can estimate  $h_{jt-5}^{a-1}$  by

$$(1) \hat{h}_{jt-5}^{a-1} = h_{jt}^a$$

The most problematic of these assumptions is likely to be that survival rates are independent of educational attainment. According to Barro and Lee (2010), this assumption holds rather well in the data for the population below 65, but not so for those over this age. Following these authors, we will modify equation (1) for the 65+ population at time  $t-5$  to allow survival rates to depend partially on education. For this age group, we will use

$$(2) \hat{h}_{jt-5}^{a-1} = \frac{h_{jt}^a}{1 - \hat{\rho}_j}$$

where  $1 - \hat{\rho}_j$  is an estimate of the relative survival rate over five years of the population 65+ with schooling  $j$ . In practice,  $j$  ranges over only two categories:  $H$  for highly educated people (with some secondary attainment or better) and  $L$  for people with a low educational level (no schooling or primary education) and is constant over time and across countries. We use Barro and Lee's (2010) estimates of relative survival rates for OECD countries,

$$1 - \rho_L = 0.966 \quad \text{and} \quad 1 - \rho_H = 1.065$$

When equation (2) is used to construct a backward projection, the estimates of  $h_{jt-5}^{a-1}$  are rescaled if necessary so that they add up exactly to 100% (across educational categories,  $j$ , at each point in time). Finally, attainment shares for the population 25+ are constructed by weighting the estimated attainment shares of the different cohorts by the observed weights of those cohorts in the 25+ population at time  $t-5$  ( $w_{t-5}^a$ ):

$$(3) \hat{h}_{jt-5}^{25+} = \sum_a w_{t-5}^a \hat{h}_{jt-5}^a$$

Table 4 lists those countries where backward projections have been used to estimate attainment shares in the sixties and seventies. The first column gives the years for which attainment shares have been estimated using this procedure, the second one the year corresponding to the detailed attainment data that have been used to construct the projection, and the third one gives the age breakdown provided in this source. The finer this breakdown is and the smaller the open-ended interval with which it ends, the more reliable the projection will be.<sup>1</sup> On the whole, the most problematic case among those listed in Table 4 is that of Belgium, where the earliest available data comes from 1981 and provides only a

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<sup>1</sup> The procedure implicitly assumes a common survival probability and a common distribution of attainment within each age group. As the age segments get larger and larger, these assumptions become more and more problematic and may induce increasingly larger biases in our estimates.

rather coarse breakdown by age. Similar but somewhat less severe problems arise in Sweden, Australia and Denmark, where the residual older category starts at 65 years of age or below. To try to mitigate the problems this poses, we have tried to approximate the attainment levels of subsets of the open-ended highest-age group, thereby extending the disaggregated attainment data to older cohorts, by extrapolating on the basis of the data available for younger ones.<sup>2</sup>

**Table 4: Backward projection estimates of attainment shares**

	<i>years estimated using BP</i>	<i>using data from</i>	<i>age breakdown available</i>
<b>Australia</b>	1961, 1966 & 1971	1976 census	5-yr groups until 65+, extended
<b>Austria</b>	1961	1971 census	5-year groups until 95+
<b>Belgium</b>	1961	1981 census	25-44, 45-64 and 65+
<b>Denmark</b>	1973	1983 register	5-yr groups until 60-62, extended
<b>Finland</b>	1960 & 1965	1970 register	5-year groups until 85+
<b>France</b>	1960	1968 census	10-year groups until 75+
<b>Greece</b>	1961 & 1971	1981 census	5-year groups until 85+
<b>Ireland</b>	1961	1966 census	5-year groups until 70+
<b>Sweden</b>	1960	1970 census	25-34, 35-44 and 45-59, extended
<b>Spain</b>	1960	1970 census	5-year groups until 70+

Since the results of the 2011 round of censuses are not yet available in many countries, in a number of cases we have had to project forward the last available census observation to 2010 using data from some other source, typically the Labor Force Survey (LFS). When census and LFS data are reasonably similar in the most recent year for which both are available, we have used the LFS data directly to complete the series. When the two sources display significant differences, however, we have preferred to project forward the last available census observation using the growth rates of attainment shares over the period of interest according to the alternative source that is available for recent years (and rescaling such shares as needed so they add up to 100% in each given year). Table 5 lists the cases when this method has been used. It shows the last available census observation, the reference attainment series whose growth rates are used to project the census results forward, and the years for which such projections are made.

**Table 5: Forward projection estimates of attainment shares**

	<i>Last available census observation</i>	<i>Projected forward to</i>	<i>Using the growth rate of attainment shares according to</i>
<b>Canada</b>	2001	2005 & 2010	LFS 25+
<b>France</b>	2008	2010	LFS 25+
<b>New Zealand</b>	2006	2010	LFS 25-64
<b>Portugal</b>	2001	2011	Preliminary census data for entire population
<b>Spain</b>	2001	2005 & 2010	LFS 25+

<sup>2</sup> See for instance the country notes for Australia. While the margin of error of this procedure is considerable, it is likely to reduce the overall error by not forcing us to apply a uniform survival probability to a very heterogeneous group that contains people of very different ages -- which, in turn, are likely to present considerable differences in average attainment.

### 2.3. Estimating primary attainment in some countries

A number of countries do not generally separate primary education from lower secondary schooling and report a single attainment level that comprises all basic or mandatory courses. To preserve the homogeneity of our attainment categories, we have estimated the breakdown of compulsory schooling into *L1* and *L2.1*. For some countries we have managed to find enough information to make what should be a reasonable guess, generally by combining information on *L1* from a single census with data on the age distribution of the population. For others, we have used data from close neighbors. In particular, we have used information for Germany and Norway to estimate the breakdown in Austria and Denmark, respectively.<sup>3</sup> The procedure used in each case is summarized in Table 6 and described in detail in the Appendix.

**Table 6: Separating *L1* from *L2.1* in some countries**

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	<i>Estimation procedure</i>
<i>Austria</i>	Data available for 1995 + use Germany's <i>L1/(L1+L2.1)</i> ratio as a reference
<i>Canada</i>	Estimated using data disaggregated by age group for 2001
<i>Denmark</i>	Data available for 1991 onward + use Norway as a reference
<i>Finland</i>	Data available for 1960 and 2008 from Unesco, DYB and EAG
<i>Germany (West)</i>	Data available for 1970, 1985 and 1996
<i>Japan</i>	Data available for 1960 + link to weight of surviving older cohorts in 25+ population
<i>Norway</i>	Data available for 1995 (disaggregated by age group) and 2009
<i>Switzerland</i>	Estimated by Swiss Statistical Office until 1999 + assume constant ratio thereafter

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- Note: For further details, see the detailed country notes in the Appendix.

### 2.4. Treatment of the "unknown attainment category"

In many countries the available data on the educational breakdown of the population contains an "unknown" or "unstated" category. In most cases, this group is rather small and we have simply ignored it, i.e. computed attainment shares as a fraction of the population whose attainment is known, which is equivalent to imputing the unknown group to the rest of the available categories in proportion to their respective size. In the cases of Australia and New Zealand, however, the weight of the unknown category is quite high (reaching up to 25% and 15% of the total adult population). Since this makes our results quite sensitive to how we allocate this group, we have dealt with the problem more carefully than in other cases. In particular, we have assumed that the probability that a person will fail to report his attainment level decreases with education. The details are discussed in the country notes for Australia and New Zealand.

### 2.5. Data availability

Data availability varies widely across countries. Table 7 shows the fraction of the reported data points that are taken from "direct observations" and the dates of the earliest and latest such observations

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<sup>3</sup> See the country notes in Section 4 below for further details.

available for secondary and higher attainment levels. The number of possible observations is typically 22 for each level of schooling (two sublevels times eleven quinquennial observations) but it may be smaller since some sublevels do not exist in certain countries.<sup>4</sup> For those countries where primary and lower secondary education are typically reported together (identified with an asterisk), the two categories included in secondary attainment for purposes of Table 7 are *L1+L2.1* and *L2.2*.

**Table 7: Summary measures of data availability**

	<i>secondary attainment</i>			<i>university attainment</i>		
	<i>direct/tot.</i> <i>observ.</i>	<i>first</i> <i>observ.</i>	<i>last</i> <i>observ.</i>	<i>direct/tot.</i> <i>obs.</i>	<i>first</i> <i>observ.</i>	<i>last</i> <i>observ.</i>
<i>Australia</i>	15/22	1961	<b>2006</b>	16/22	1961	<b>2006</b>
<i>Austria*</i>	14/22	1961	2010	14/22	1961	2010
<b><i>Belgium</i></b>	12/22	1961	2010	14/22	1961	2010
<i>Canada*</i>	20/22	1961	2010	20/22	1961	2010
<b><i>Denmark*</i></b>	14/22	<b>1973</b>	2010	14/22	<b>1973</b>	2010
<i>Finland*</i>	22/22	1960	2010	22/22	1960	2010
<b><i>France</i></b>	16/22	1960	2010	11/22	1960	2010
<i>Greece</i>	12/22	1961	2010	12/22	1961	2010
<i>W. Germany*</i>	8/14	<b>1970</b>	1991	13/14	1961	1991
<i>United Germany</i>	9/10	1991	2010	10/10	1991	2010
<i>Ireland</i>	10/22	1961	2006	9/22	1961	2006
<i>Italy</i>	14/22	1961	2010	7/11	1961	2010
<i>Japan*</i>	12/22	1960	2010	12/22	1960	2010
<i>Netherlands</i>	14/22	1960	2010	14/22	1960	2010
<i>N. Zealand</i>	14/22	<b>1966</b>	2008	14/22	<b>1966</b>	2008
<i>Norway*</i>	18/22	1960	2010	18/22	1960	2010
<i>Portugal</i>	11/22	1960	2011	11/22	1960	2011
<i>Spain</i>	14/22	1960	2010	14/22	1960	2010
<i>Sweden</i>	16/22	1960	2010	16/22	1960	2010
<i>Switzerland*</i>	13/22	1960	2010	13/22	1960	2010
<i>UK</i>	12/22	1961	2010	10/22	1961	2010
<i>USA</i>	22/22	1960	2010	22/22	1960	2010

- (\*) Countries where primary and lower secondary attainment are generally not reported separately.

In addition to data from national censuses, labor force surveys and educational registers, we count as direct observations backward projections constructed using census data on educational attainment broken down by age group and the age structure of the population and various "reasonable guesses" that incorporate some information from census or survey data. As can be seen in the table, for most of the countries in the sample we have enough primary information to reconstruct reasonable attainment series covering the whole sample period. The more problematic cases are highlighted using bold characters. For Denmark and West Germany (in the case of secondary education) the earliest available direct observation refers to 1970 or later. In these two cases, we have projected attainment rates backward to 1960 using the (rather tenuous) relevant information we could find, but we are unsure of the reliability of our estimates. Belgium is also a problematic case because even though we can

<sup>4</sup> In the case of Italy, there seem to be no short higher education courses, so the number of possible observations

construct a backward projection for 1961 using data from the 1981 census, the period over which we are extrapolating is long and the available age breakdown of the population is rather coarse.

### 3. Data tables

Tables 8-15 contain our estimates of attainment levels and average years of schooling for the adult population of OECD countries. We report an illiteracy series for four countries (Spain, Italy, Greece and Portugal). For the remaining countries, illiteracy rates are extremely low and are therefore ignored.

**Table 8: Average years of schooling**

	1960	1965	1970	1975	1980	1985	1990	1995	2000	2005	2010
<i>Australia</i>	10.23	10.33	10.46	10.61	10.89	11.08	11.33	11.61	11.88	12.15	12.47
<i>Austria</i>	9.22	9.40	9.57	9.83	10.11	10.43	10.71	10.94	11.17	11.65	11.93
<i>Belgium</i>	7.28	7.57	7.86	8.11	8.35	8.74	9.17	9.77	10.41	10.85	11.29
<i>Canada</i>	9.88	10.23	10.62	11.11	11.63	11.97	12.29	12.55	12.80	13.04	13.29
<i>Denmark</i>	10.34	10.50	10.65	10.83	11.01	11.15	11.22	11.44	11.70	11.95	12.13
<i>Finland</i>	7.89	8.18	8.53	8.97	9.42	9.89	10.36	10.82	11.25	11.67	12.07
<i>France</i>	6.43	6.67	7.03	7.56	8.09	8.71	9.40	9.97	10.57	11.29	11.89
<i>Germany (West)</i>	9.60	10.04	10.48	10.92	11.35	11.82	12.01				
<i>Germany*</i>							11.95	12.03	12.05	12.11	12.21
<i>Greece</i>	5.43	5.75	6.06	6.48	6.93	7.38	7.84	8.46	9.12	9.64	10.12
<i>Ireland</i>	7.46	7.60	7.72	8.10	8.54	8.99	9.45	9.97	10.50	11.05	11.59
<i>Italy</i>	4.95	5.21	5.46	5.94	6.48	7.00	7.51	8.15	8.83	9.51	9.99
<i>Japan</i>	8.59	9.02	9.46	9.99	10.52	10.92	11.31	11.61	11.90	12.16	12.43
<i>Netherlands</i>	8.09	8.45	8.81	9.29	9.81	10.32	10.84	11.26	11.63	12.15	12.36
<i>New Zealand</i>	7.75	8.08	8.41	8.73	9.06	9.39	9.86	10.10	10.67	11.15	11.31
<i>Norway</i>	10.96	11.22	11.48	11.69	11.90	12.05	12.22	12.43	12.68	12.90	13.11
<i>Portugal</i>	3.75	3.81	3.86	4.46	5.06	5.69	6.33	6.96	7.58	8.22	8.88
<i>Spain</i>	4.70	4.82	4.95	5.30	5.66	6.17	6.73	7.42	8.13	8.97	9.39
<i>Sweden</i>	9.04	9.30	9.57	10.05	10.53	11.02	11.65	12.14	12.67	13.08	13.40
<i>Switzerland</i>	10.28	10.53	10.78	10.96	11.13	11.35	11.57	11.81	11.94	12.12	12.35
<i>UK</i>	6.69	7.13	7.58	8.03	8.48	9.08	9.70	10.40	10.86	11.18	11.60
<i>USA</i>	10.56	10.97	11.33	11.76	12.14	12.44	12.66	13.01	13.19	13.30	13.46

(\*) *Germany* refers to the united country. In this case, the "1990" observations refer to 1991.

**Table 9: Illiteracy rates (%)**

	1960	1965	1970	1975	1980	1985	1990	1995	2000	2005	2010
<i>Greece</i>	24.80	21.74	18.69	15.45	12.16	10.44	9.11	7.14	5.03	3.81	2.82
<i>Italy</i>	12.99	10.60	8.21	6.44	4.83	3.88	3.10	2.50	1.95	1.60	1.33
<i>Portugal</i>	45.00	44.60	44.20	36.60	29.00	22.96	17.32	14.10	11.48	9.55	7.78
<i>Spain</i>	15.02	13.91	12.80	10.97	9.15	7.01	4.79	3.79	3.09	1.86	1.90

at the university level drops to eleven.

**Table 10: Primary attainment shares (%)**

	1960	1965	1970	1975	1980	1985	1990	1995	2000	2005	2010
<i>Australia</i>	15.80	14.20	12.42	10.80	7.75	6.89	6.75	6.62	6.50	6.85	6.16
<i>Austria</i>	4.63	3.95	3.20	2.47	1.62	0.64	0.74	0.71	0.71	0.72	0.87
<i>Belgium</i>	72.41	67.47	62.54	58.11	53.69	48.87	43.96	36.71	28.88	24.83	20.36
<i>Canada</i>	11.40	10.05	8.54	7.23	5.74	4.74	3.79	3.20	2.65	2.19	1.69
<i>Denmark</i>	2.30	2.21	2.11	2.02	1.93	1.84	1.75	1.32	0.96	0.69	0.65
<i>Finland</i>	61.89	56.38	50.87	45.36	39.85	34.34	28.83	23.33	17.82	12.31	6.80
<i>France</i>	79.25	76.07	71.46	64.71	57.99	49.74	40.49	34.11	27.54	20.19	14.85
<i>Germany (West)</i>	23.07	18.62	14.17	10.16	6.15	2.15	2.22				
<i>Germany*</i>							3.00	2.94	3.19	3.74	4.34
<i>Greece</i>	59.82	60.87	61.93	61.78	61.32	58.12	54.24	49.08	43.61	38.94	34.47
<i>Ireland</i>	73.11	70.55	68.35	61.68	53.88	46.81	39.92	33.31	26.78	21.30	16.53
<i>Italy</i>	74.55	73.98	73.40	67.61	60.51	53.27	45.99	39.97	34.27	29.64	24.84
<i>Japan</i>	49.46	41.49	33.52	26.34	19.16	15.14	11.12	8.62	6.12	4.46	2.81
<i>Netherlands</i>	56.10	49.37	42.64	36.60	30.73	24.86	18.99	15.00	12.06	8.34	7.64
<i>New Zealand</i>	84.79	78.75	72.71	66.66	60.62	54.58	47.20	44.55	34.33	28.43	27.21
<i>Norway</i>	2.14	2.05	1.97	1.88	1.80	1.71	1.63	1.54	1.10	0.65	0.30
<i>Portugal</i>	47.10	47.04	46.99	52.16	57.33	59.69	61.35	58.82	55.24	51.29	47.24
<i>Spain</i>	78.55	78.56	78.58	75.50	72.43	67.57	62.26	52.71	42.10	32.13	27.46
<i>Sweden</i>	64.94	60.45	55.97	49.29	42.61	35.92	27.27	20.63	14.87	10.86	8.02
<i>Switzerland</i>	31.23	26.47	21.71	19.04	16.37	13.70	11.04	9.28	8.65	8.10	7.68
<i>UK</i>	71.75	65.59	59.44	53.28	47.12	39.54	31.60	21.88	16.90	14.43	11.27
<i>USA</i>	8.35	6.76	5.26	4.20	3.37	2.70	2.45	1.85	1.56	1.58	1.31

**Table 11: Lower secondary attainment shares (%)**

	1960	1965	1970	1975	1980	1985	1990	1995	2000	2005	2010
<i>Australia</i>	49.94	50.14	49.90	48.67	46.56	42.84	36.95	30.61	24.27	17.42	11.38
<i>Austria</i>	64.39	61.84	59.35	55.17	50.68	46.21	40.62	36.70	33.12	25.08	21.00
<i>Belgium</i>	17.26	19.14	21.01	22.86	24.71	24.04	22.74	21.89	21.16	18.60	17.91
<i>Canada</i>	38.01	34.33	30.32	25.90	20.57	16.76	13.24	11.10	9.14	7.54	5.80
<i>Denmark</i>	56.75	54.41	52.07	47.69	43.30	40.34	39.51	35.60	30.92	27.01	23.62
<i>Finland</i>	21.80	24.30	25.58	24.74	23.48	21.99	20.50	20.37	20.84	21.50	22.76
<i>France</i>	5.08	5.14	5.43	6.06	6.59	7.56	8.82	8.86	8.72	7.89	7.03
<i>Germany (West)</i>	36.31	34.99	33.66	30.85	28.07	24.90	19.27				
<i>Germany*</i>							16.39	15.08	14.41	11.93	8.31
<i>Greece</i>	4.04	4.38	4.72	5.30	5.94	6.15	6.25	7.15	8.26	8.95	9.55
<i>Ireland</i>	9.47	10.42	11.19	13.38	15.94	17.79	19.47	20.79	22.03	21.44	19.61
<i>Italy</i>	9.62	11.95	14.27	19.09	24.53	28.69	32.55	32.66	31.83	28.26	29.03
<i>Japan</i>	21.80	24.81	27.83	27.23	26.64	24.94	23.25	21.54	19.83	18.11	16.40
<i>Netherlands</i>	33.50	37.81	42.13	40.12	36.52	32.93	29.34	26.95	24.71	21.07	19.33
<i>New Zealand</i>	7.02	8.26	9.50	10.74	11.98	13.22	12.59	11.81	14.10	13.08	12.43
<i>Norway</i>	68.47	61.37	54.27	49.38	44.49	41.41	38.10	33.92	29.70	26.77	24.42
<i>Portugal</i>	2.90	3.26	3.62	4.85	6.08	6.76	7.31	7.78	8.23	8.60	8.95
<i>Spain</i>	1.76	2.15	2.53	5.31	8.09	10.81	13.52	18.70	24.49	28.10	29.26
<i>Sweden</i>	7.25	8.39	9.53	10.10	10.66	11.23	11.25	11.17	10.40	10.10	9.90
<i>Switzerland</i>	21.19	20.58	19.98	19.58	19.17	18.13	17.09	14.88	14.56	13.63	12.93
<i>UK</i>	19.64	21.53	23.41	25.29	27.18	29.06	30.94	35.65	36.28	35.71	34.62
<i>USA</i>	31.39	26.21	22.43	17.65	14.13	11.16	8.79	6.53	5.39	4.72	3.92

**Table 12: Upper secondary attainment shares (%)**

	1960	1965	1970	1975	1980	1985	1990	1995	2000	2005	2010
<i>Australia</i>	27.97	28.99	30.41	32.56	36.26	39.16	41.70	44.22	46.74	48.80	50.96
<i>Austria</i>	26.73	29.62	32.51	36.58	40.95	44.89	48.73	50.67	52.13	55.81	57.12
<i>Belgium</i>	6.16	7.68	9.20	10.67	12.14	15.22	18.69	22.97	27.45	30.61	31.73
<i>Canada</i>	38.23	39.22	40.63	37.61	37.49	38.16	39.21	37.73	36.36	34.25	32.48
<i>Denmark</i>	34.29	34.03	33.76	36.36	38.96	40.33	39.84	41.90	43.78	44.37	44.59
<i>Finland</i>	9.00	10.71	13.24	17.15	21.52	26.01	30.36	32.61	34.42	36.66	38.31
<i>France</i>	12.31	14.99	18.20	22.21	26.47	31.59	37.27	39.94	42.69	45.76	47.11
<i>Germany (West)</i>	34.19	38.29	42.40	47.50	52.60	57.27	60.46				
<i>Germany*</i>							63.39	63.85	63.26	64.16	65.26
<i>Greece</i>	7.82	8.85	9.89	11.50	13.27	16.31	19.67	22.48	25.15	26.06	26.52
<i>Ireland</i>	13.45	14.79	15.89	19.00	22.63	25.26	27.64	27.85	27.52	27.69	28.21
<i>Italy</i>	1.08	1.49	1.90	4.07	6.69	10.20	13.93	18.67	23.67	30.44	32.67
<i>Japan</i>	21.66	25.38	29.10	34.42	39.74	42.07	44.40	45.47	46.54	46.49	46.44
<i>Netherlands</i>	7.10	8.18	9.26	15.07	22.05	29.03	36.01	38.67	40.27	41.99	40.60
<i>New Zealand</i>	3.00	6.11	9.22	12.33	15.44	18.55	23.35	24.31	29.54	32.66	32.48
<i>Norway</i>	24.25	29.90	35.55	38.39	41.23	42.26	43.21	44.34	45.32	45.19	44.20
<i>Portugal</i>	3.50	3.34	3.18	3.49	3.80	5.27	7.04	10.00	13.25	14.41	15.04
<i>Spain</i>	1.76	2.04	2.33	3.03	3.73	7.06	11.04	14.05	16.81	20.86	21.88
<i>Sweden</i>	22.97	25.41	27.85	30.66	33.47	36.27	40.95	44.18	46.42	46.32	45.54
<i>Switzerland</i>	43.34	47.15	50.95	52.21	53.48	54.05	54.63	56.74	55.36	52.98	48.33
<i>UK</i>	5.51	8.07	10.63	13.19	15.76	18.32	20.88	22.99	23.64	23.55	22.86
<i>USA</i>	43.81	48.74	51.06	51.83	50.63	50.46	49.56	43.87	42.09	40.66	38.87

**Table 13: First cycle of higher education, attainment shares (%)**

	1960	1965	1970	1975	1980	1985	1990	1995	2000	2005	2010
<i>Australia</i>	3.97	4.09	4.29	4.44	4.61	4.75	5.47	6.33	7.19	8.40	9.69
<i>Austria</i>	2.10	2.29	2.48	2.88	3.33	4.23	5.26	6.41	7.59	10.46	10.52
<i>Belgium</i>	2.68	3.73	4.79	5.48	6.17	7.69	9.43	10.92	12.34	14.48	15.46
<i>Canada</i>	9.07	12.22	15.37	22.16	27.03	29.58	31.28	33.51	34.92	36.22	37.12
<i>Denmark</i>	4.94	6.94	8.93	10.50	12.08	13.45	14.52	15.88	17.71	19.69	22.66
<i>Finland</i>	5.63	6.69	8.17	10.08	11.91	13.77	15.56	17.92	19.89	21.22	22.26
<i>France</i>	1.19	1.36	1.78	2.59	3.53	4.54	5.61	7.73	9.91	12.32	13.76
<i>Germany (West)</i>	4.41	4.76	5.11	5.46	5.97	6.74	7.48				
<i>Germany*</i>							8.39	7.99	8.42	7.95	7.95
<i>Greece</i>	1.07	1.27	1.46	1.88	2.37	2.61	2.79	4.56	6.73	9.47	12.36
<i>Ireland</i>	1.22	1.34	1.48	1.98	2.57	3.55	4.62	6.60	8.81	10.79	12.60
<i>Italy</i>	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
<i>Japan</i>	3.61	3.78	3.96	4.73	5.50	7.03	8.56	10.15	11.73	13.09	14.45
<i>Netherlands</i>	1.90	3.11	4.32	5.92	7.62	9.32	11.02	13.74	15.00	17.76	20.63
<i>New Zealand</i>	3.97	4.78	5.59	6.39	7.20	8.01	9.95	10.36	10.71	10.21	9.57
<i>Norway</i>	3.84	4.98	6.13	7.83	9.54	11.25	13.22	15.74	18.48	20.96	23.21
<i>Portugal</i>	0.40	0.51	0.61	0.96	1.30	1.66	2.01	2.73	3.54	5.11	6.87
<i>Spain</i>	1.54	1.88	2.21	3.03	3.85	4.12	4.24	5.25	6.47	8.10	9.66
<i>Sweden</i>	2.10	2.41	2.71	4.33	5.96	7.59	10.14	12.56	12.96	13.51	14.11
<i>Switzerland</i>	1.47	2.74	4.00	5.08	6.15	8.63	11.10	11.08	11.66	13.76	16.89
<i>UK</i>	2.70	4.19	5.67	7.13	8.58	11.44	14.66	16.53	19.33	20.65	24.19
<i>USA</i>	8.79	8.85	10.21	12.42	14.86	16.31	17.93	24.78	25.36	25.39	25.97

**Table 14: Second cycle of higher education, attainment shares (%)**

	1960	1965	1970	1975	1980	1985	1990	1995	2000	2005	2010
<i>Australia</i>	2.33	2.59	2.98	3.52	4.80	6.36	9.14	12.22	15.30	18.53	21.81
<i>Austria</i>	2.15	2.31	2.47	2.91	3.42	4.02	4.65	5.52	6.45	7.93	10.49
<i>Belgium</i>	1.49	1.98	2.46	2.88	3.29	4.18	5.18	7.51	10.16	11.47	14.54
<i>Canada</i>	3.29	4.18	5.14	7.11	9.17	10.77	12.49	14.46	16.91	19.80	22.91
<i>Denmark</i>	1.73	2.42	3.12	3.42	3.73	4.04	4.38	5.31	6.63	8.24	8.48
<i>Finland</i>	1.67	1.92	2.13	2.67	3.24	3.89	4.74	5.78	7.03	8.32	9.87
<i>France</i>	2.16	2.43	3.12	4.43	5.43	6.57	7.82	9.36	11.13	13.84	17.26
<i>Germany (West)</i>	2.02	3.34	4.66	6.03	7.21	8.95	10.57				
<i>Germany*</i>							8.83	10.15	10.73	12.21	14.14
<i>Greece</i>	2.45	2.89	3.33	4.09	4.94	6.37	7.95	9.58	11.22	12.76	14.27
<i>Ireland</i>	2.74	2.90	3.09	3.96	4.99	6.60	8.36	11.44	14.86	18.78	23.05
<i>Italy</i>	1.76	1.99	2.22	2.78	3.44	3.96	4.44	6.20	8.28	10.06	12.13
<i>Japan</i>	3.47	4.53	5.60	7.28	8.95	10.81	12.67	14.22	15.77	17.84	19.92
<i>Netherlands</i>	1.40	1.53	1.65	2.30	3.08	3.86	4.64	5.64	7.97	10.84	11.80
<i>New Zealand</i>	1.21	2.10	2.99	3.87	4.76	5.64	6.91	8.96	11.31	15.62	18.31
<i>Norway</i>	1.31	1.70	2.09	2.52	2.94	3.37	3.85	4.46	5.41	6.43	7.87
<i>Portugal</i>	1.10	1.25	1.40	1.94	2.49	3.65	4.96	6.57	8.25	11.04	14.12
<i>Spain</i>	1.36	1.46	1.55	2.15	2.74	3.43	4.14	5.51	7.05	8.95	9.84
<i>Sweden</i>	2.73	3.33	3.94	5.62	7.30	8.98	10.40	11.46	15.34	19.21	22.43
<i>Switzerland</i>	2.77	3.06	3.36	4.09	4.83	5.49	6.14	8.03	9.78	11.54	14.16
<i>UK</i>	0.40	0.63	0.85	1.11	1.37	1.64	1.91	2.95	3.85	5.66	7.07
<i>USA</i>	7.66	9.44	11.03	13.90	17.02	19.38	21.27	22.97	25.59	27.66	29.93

**Table 15: Vocational track of upper secondary education, attainment shares (%)**

	1960	1965	1970	1975	1980	1985	1990	1995	2000	2005	2010
<i>Australia</i>	23.21	23.87	24.54	24.71	26.36	26.42	25.44	24.21	22.97	23.79	25.12
<i>Austria</i>	24.43	27.02	29.61	33.39	37.46	41.03	44.48	46.34	47.81	50.77	51.85
<i>Belgium</i>					6.21				19.60		
<i>Canada</i>											
<i>Denmark</i>				35.32	37.39	38.08	36.75	38.18	39.51	40.02	40.41
<i>Finland</i>											
<i>France</i>	6.38	8.13	10.16	12.59	14.93	18.08	21.77	24.81	27.31	27.63	27.59
<i>Germany (West)</i>				44.51	48.49	50.84	52.32				
<i>Germany*</i>							56.18	56.21	53.51	52.63	52.46
<i>Greece</i>											
<i>Ireland</i>											
<i>Italy</i>											
<i>Japan</i>											
<i>Netherlands</i>			5.81	11.72	17.63	23.54	29.45	30.83	32.22	33.53	33.52
<i>New Zealand</i>									11.07	11.03	
<i>Norway</i>											
<i>Portugal</i>											
<i>Spain</i>			0.45	0.74	1.03	2.44	4.12	5.95	7.82		
<i>Sweden</i>											
<i>Switzerland</i>									47.87	44.93	40.77
<i>UK</i>											
<i>USA</i>	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00

## APPENDIX: Detailed country notes

### 1. Australia

#### *Structure of the system*

Schooling is mandatory between the ages of 6 and 16. Depending on the state, primary school lasts for 6 or 7 years (plus a pre-school or kindergarten year). It is followed by (lower) secondary schooling, which lasts for 3 or 4 years until grade 10. Lower secondary school graduates can go on to a senior secondary school for two additional years (until grade 12) and then to university or enter a vocational training institution. Universities offer both short degrees with durations of up to two years (diplomas, advanced diplomas and associate degrees) and long degrees (bachelors, masters and doctorates) that require at least three years of study (and generally four or more). The lowest level of vocational training leads to a certificate qualification (which takes between six months and two years to complete on a full-time basis). Further study can lead to qualifications that are equivalent to short (diploma and advanced diploma) or long university degrees (vocational graduate diplomas and certificates).

A helpful description of the Australian educational system can be found at

<https://www.aei.gov.au/Services-And-Resources/Services/Country-Education-Profiles/About-CEP/Documents/Australia.pdf>

[http://en.wikipedia.org/wiki/Education\\_in\\_Australia](http://en.wikipedia.org/wiki/Education_in_Australia)

[http://www.ibe.unesco.org/fileadmin/user\\_upload/Publications/WDE/2010/pdf-versions/Australia.pdf](http://www.ibe.unesco.org/fileadmin/user_upload/Publications/WDE/2010/pdf-versions/Australia.pdf)

#### *Attainment categories*

- *L3.2* includes those people with a bachelor's or a higher degree (including master's, doctorate and other graduate degrees, diplomas and certificates). People with undergraduate diplomas, advanced diplomas and associate degrees are included in *L3.1*.

- The boundary between *L2.2* and *L3.1* is a bit fuzzy in the case of vocational education. We have included in *L2.2voc* apprenticeships and short vocational training courses leading to qualifications typically known as "certificates", both of which can be pursued by people who have not completed senior secondary school. In 1976, we also include in *L2.2voc* qualifications "not classified by level" because the explanatory notes for the 1971 census, which uses the same classification scheme, indicate that this group is largely comprised of people with low level vocational qualifications.

- *L1* includes those with 6 years of schooling or less or who left school at age 12 or less. *L2.1* is assumed to last for four years. *L2.2* includes those who stayed in school until the 11<sup>th</sup> grade or 17 years of age.

#### *Data sources and structure*

Our primary data on the educational attainment of the population 25+ come from the National Censuses of 1976, 1981, 1986, 2001, 2006 and 2011. The 1991 and 1996 censuses provide data only for

the 15+ population and the 1966 and 1971 censuses provide data for the entire population or for other age groups different from the one we are interested in (25+). These sources are not used except as an indirect check to assess the plausibility of some of our projections.

Census data are available at

<http://www.abs.gov.au/websitedbs/censushome.nsf/home/data>

for 1996 onward and at

<http://www.abs.gov.au/AUSSTATS/abs@.nsf/ViewContent?readform&view=ProductsbyCatalogue&Action=Expand&Num=2.2>

for previous years. Partial results for the 2011 census (school grades completed) can be found at:

[http://www.censusdata.abs.gov.au/census\\_services/getproduct/census/2011/communityprofile/0](http://www.censusdata.abs.gov.au/census_services/getproduct/census/2011/communityprofile/0)

A second round of tables, including post-school qualifications, should be available in October 2012.

- Two separate census tables are relevant for our purposes. Depending on the year, the first table gives the breakdown of the population according to either the age at which they left (primary or secondary) school or the last grade they attended or completed (it is not always clear which). The second table contains information on the population that has obtained some sort of post-school qualification, either academic or vocational. Notice that, while the second table gives us information on the “terminal” attainment of a segment of the population (with a completion criterion), the first one does not, as many of those who entered (but not necessarily completed) secondary schooling have gone on to earn some post-school qualifications. Hence, the second table can be used directly to compute  $L3.1$ ,  $L3.2$  and the vocational training component of  $L2.2$  (denoted by  $L2.2voc$ ). If we assume that some secondary education is required for all post-school qualifications (which should be at least approximately true), the first table can be used to calculate the primary attainment share. Secondary attainment shares obtained from the first table, however, include people who have gone on to higher training and need therefore to be adjusted. These “gross” secondary attainment shares will be denoted by  $L2.1^+$  and  $L2.2^+$ .

To adjust the gross shares and obtain attainment shares based on individuals’ highest qualification, we have assumed that those that hold vocational qualifications we have classified as  $L2.2voc$  are a subset of those who have left school after entering or possibly completing the first cycle of secondary ( $L2.1^+$ ) while those who hold higher vocational qualifications and university degrees ( $L3.1$  and  $L3.2$ ) are included in those who have left school after entering or completing the second cycle of secondary education ( $L2.2^+$ ). Hence, our final estimates of secondary attainment shares are constructed as follows:

$$L2.2 = L2.2^+ - (L3.1 + L3.2) + L2.2voc = L2.2ac + L2.2voc$$

$$L2.1 = L2.1^+ - L2.2voc$$

### *Estimation and fill-in procedure*

- Data for 1976, 1981, 1986, 2001 and 2006 are taken directly from census sources with only a minor adjustment in the case of 1981 (see below). Attainment levels in 1961, 1966 and 1971 are estimated using a backward projection constructed with census data for 1976 disaggregated by 5-year age brackets (see below). Estimates for 1960 are linear extrapolations using the closest available census data. Those for 1991 and 1996 are obtained by linear interpolation between 1986 and 2001. Linear interpolation is also used to construct estimates for years ended in 0 and 5. For 2010 we first estimate attainment shares in 2011 and then interpolate between 2006 and 2011. For 2011, gross school attainment shares can be calculated using census data. Post-school qualifications, however, are not yet available. We have estimated the relevant attainment shares (*L2.2voc*, *L3.1* and *L3.2*) by extrapolation using 2001 and 2006 data and recovered net attainment shares in the usual way.

- *Treatment of unknowns*: Census tables typically include one or more separate categories for the population whose attainment level is unknown because of lack of response (“not stated”) or because the answer does not allow a precise classification of the respondent’s qualifications. Since this problem affects a considerable fraction of the population in all census years, our estimates of attainment shares are sensitive to the way we deal with this problem, which is as follows. In the case of people who claim to have a post-school qualification but do not state which one or give suspicious answers or insufficient information to determine the level of their supposed qualification (between 23 and 37% of the relevant population) we have assumed that 1/3 of them do not really possess a valid qualifications. Half of the remaining two thirds have been allocated across the relevant attainment levels (*L2.2voc*, *L3.1* and *L3.2*) in proportion to their weights in the population that gave clear answers and the final 1/3 has been allocated to the lowest of these attainment levels (*L2.2voc*). In the case of people who do not state the age or the grade at which they left school (between 5 and 11% of the relevant population), we proceed in a similar way: half of them are allocated to the lowest possible level (*L0+L1*) and the remaining half are allocated among all schooling categories (*L0+L1*, *L2.1+* and *L2.2+*) in proportion to their original weights.

- To relate data on school leaving ages to the highest grade attended or completed, we have assumed that students start primary schooling at the age of 6 and do not repeat. We have assigned those with 0 to 6 grades or years of school attendance to *L1* (which actually includes *L0* as well), those with up to 10 years of schooling to *L2.1*<sup>+</sup> and those with 11 or 12 years to *L2.2*<sup>+</sup>. While there is some variation across states, this appears to be the most common situation.

In 2001, 2006 and 2011, the lowest level reported is 8<sup>th</sup> grade or less. To estimate *L0+L1*, we observe that the ratio between 6<sup>th</sup> grade or less and 8<sup>th</sup> grade or less is roughly constant at 0.10 in the three census years for which data on both categories are available. We apply this percentage to the data on 8<sup>th</sup> grade or less to estimate *L0+L1* in 2001, 2006 and 2011.

- *Correction to the 1981 census*: The breakdown of *L.2* into *L2.1* and *L2.2* in this year looks suspicious relative to adjacent census years. To obtain a pattern consistent with them, we interpolate the ratio *L2.2/L2* between 1976 and 1986 and apply it to the observed *L2* total in 1981. We proceed in a similar

way to estimate  $L2.2voc$ : we interpolate the ratio  $L2.2voc/L2.2$  between 1976 and 1986 and apply it to the estimated  $L2.2$  total in 1981.

- *Backward projections*

As noted, our estimates of attainment shares in 1961, 1966 and 1971 are obtained by backward projection of the detailed data on attainment by age group given in the 1976 census using data on the age structure of the population in the years of interest.

The highest age group given in the 1976 census is the open-ended category 65+. We start out by breaking up this category into 5-year age groups until the age of 100 and estimating the attainment level of each of these groups. This is done by extrapolating forward the observed difference between the last two observed 5-year age brackets (60-64 vs. 55-59).<sup>5</sup> We have checked that the weighted average of the attainment shares of these cohorts (weighted by their observed shares in the 65+ population) is approximately consistent with the observed attainment shares of the 65+ population as a whole.

Working with this refined age grid, the attainment shares of each cohort are simply moved back in time 5 years at a time, corrected for the differential mortality rates of high and low-education individuals for all cohorts aged 65 and over, and reweighted with the actual weights of the different age brackets in each year of interest. As discussed in the text, given the share of the population of age group  $a$  that has attained educational level  $j$  at time  $t$  ( $h_{jt}^a$ ), we estimate the attainment share of the same cohort five years earlier (at which time it constituted age group  $a-1$ ) by

$$(A.1) \hat{h}_{jt-5}^{a-1} = h_{jt}^a$$

for the population aged below 65 at  $t-5$  and by

$$(A.2) \hat{h}_{jt-5}^{a-1} = \frac{h_{jt}^a}{1 - \hat{\rho}_j}$$

for those aged 65 and over at time  $t-5$ , where  $1 - \hat{\rho}_j$  is an estimate of the relative survival rate over five years for the population 65+ with schooling  $j$  where  $j$  ranges over only two categories:  $H$  for highly educated people (with some secondary attainment or better) and  $L$  for low education (no schooling or primary education). When equation (A.2) is used, the estimates of  $\hat{h}_{jt-5}^{a-1}$  are rescaled if necessary so that they add up (across educational categories,  $j$ ) exactly to 100%. These formulas are applied recursively starting in 1971 and proceeding backward to 1961.

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<sup>5</sup> While this procedure can only yield an approximation to the distribution of attainment within each cohort of the 65+ population, it seems preferable to the alternative of implicitly assuming that all such cohorts have the same level of schooling and the same survival probabilities. As we move back in time, this procedure would generate an increasingly greater bias by overestimating the survival probabilities of the older cohorts, which are also likely to be the least educated ones.

- Summary table

Table A.1 summarizes the data sources and the estimation method used to construct the attainment series for Australia. Notice that interpolations are generally constructed taking into account the exact year to which the original observation refers, rather than bringing them to the beginning or the end of the quinquennium.

**Table A.1: Summary of data sources and fill-in procedure for Australia**

<i>level</i>	1960	1961	1965	1966	1970	1971	1975	1976	1980	1981
<i>L1</i>	ext	<b>BP</b>	int	<b>BP</b>	int	<b>BP</b>	int	<b>C</b>	int	<b>C</b>
<i>L2</i>										<b>C</b>
<i>L2.1</i>	ext	<b>BP</b>	int	<b>BP</b>	int	<b>BP</b>	int	<b>C</b>	int	est
<i>L2.2</i>	est	<b>BP</b>	int	<b>BP</b>	int	<b>BP</b>	int	<b>C</b>	int	est
<i>L3.1</i>	ext	<b>BP</b>	int	<b>BP</b>	int	<b>BP</b>	int	<b>C</b>	int	<b>C</b>
<i>L3.2</i>	ext	<b>BP</b>	int	<b>BP</b>	int	<b>BP</b>	int	<b>C</b>	int	<b>C</b>
<i>level</i>	1985	1986	1990	1995	2000	2001	2005	2006	2010	2011
<i>L1</i>	int	<b>C</b>	int	int	int	<b>C</b>	int	<b>C</b>	int	<b>C</b>
<i>L2.1</i>	int	<b>C</b>	int	int	int	<b>C</b>	int	<b>C</b>	int	est C
<i>L2.2</i>	int	<b>C</b>	int	int	int	<b>C</b>	int	<b>C</b>	int	est C
<i>L3.1</i>	int	<b>C</b>	int	int	int	<b>C</b>	int	<b>C</b>	ext	ext
<i>L3.2</i>	int	<b>C</b>	int	int	int	<b>C</b>	int	<b>C</b>	ext	ext

- Note: "Direct observations for purposes of Table 7 are highlighted in bold type.

The notation that will be used in these tables to identify different data sources is as follows:

*C* = national census

*S* = survey (generally, but not always, the Labor Force Survey)

*R* = education register

*BP* = backward projection using census data disaggregated by age group

*PrX* = forward projection of the attainment series using the growth rates of attainment according to a different source

*int* = linear interpolation between available observations

*ext* = linear extrapolation of closest available observations

*est X* = estimate based on data from source X

*Nat* = data provided directly by national statistical institutes that may include some elaboration. Presumably most such data come from censuses or surveys. If we know the source and know that the data have not been adjusted in any way, we give the original source.

*Une* = Unesco Yearbooks

*DYB* = UN Demographic yearbooks

*EAG* = Education at a Glance.

*Ybk* = National Statistical Yearbook

*Oecd* = data provided by the OECD for our previous paper, generally based on the LFS

## 2. Austria

### *Structure of the system*

Education is mandatory between the ages of 6 and 15. It has been mandatory between 6 and 12 since 1775. After four years of primary school (*Volkschule*), students choose between two types of secondary schools. The first one, known as *Gymnasium* or AHS, provides two 4-year cycles of general, academically-oriented education to prepare students for entering a university. The second type, known as *Hauptschulen* or middle schools, last for 4 years and have a vocational orientation. Middle school graduates can take an additional year of schooling before entering an apprenticeship program, enter a vocational school or enter the second cycle of AHS. Post-secondary education includes universities and technical universities, which traditionally have offered long programs (this is changing in recent years due to the introduction of shorter Bologna degrees) and various types of advanced vocational and professional training, including teacher and nurse training academies, which generally offer shorter courses of study.

For further details on the structure of the Austrian educational system see for instance

<https://webgate.ec.europa.eu/fpfis/mwikis/eurydice/index.php/Austria:Overview>

[http://en.wikipedia.org/wiki/Education\\_in\\_Austria](http://en.wikipedia.org/wiki/Education_in_Austria)

<http://www.euroeducation.net/prof/ausco.htm>

[http://www.oead.at/welcome\\_to\\_austria/education\\_research/the\\_austrian\\_education\\_system/EN/](http://www.oead.at/welcome_to_austria/education_research/the_austrian_education_system/EN/)

[http://www.dynot.net/index.php?option=com\\_content&task=view&id=37&Itemid=71](http://www.dynot.net/index.php?option=com_content&task=view&id=37&Itemid=71)

### *Attainment categories*

Austrian statistics generally do not report primary schooling separately. For most years, the lowest category ("compulsory secondary school") corresponds to  $L1+L2.1$  and includes those who have not completed this level or even received any formal education. Since we only have one direct observation for  $L1$ , we estimate its profile taking as a reference the German ratio  $L1/(L1+L2.1)$ . (See below).

$L2.2$  = apprenticeship training, intermediate vocational school and general secondary school;  $L3.1$  = higher vocational school, technical and vocational training courses, post-secondary course and academies providing vocational education or teacher training;  $L3.2$  = universities and universities of applied sciences. From  $L2.2$  upward, the data refer to people who have completed each level.

### *Data sources*

We use data on the population 25+ from the censuses of 1971, 1981, 1991 and 2001 and from the Labor Force Survey (LFS) for 2005 and 2010, both taken from the website of Statistics Austria. There are also data for the 2009 census (which display small but noticeable differences with the LFS for the same year). The main (English) web page for Statistics Austria is

[http://www.statistik.at/web\\_en/](http://www.statistik.at/web_en/)

The data we use are taken from the on-line statistical data base SDB. To access SDB from the main page, choose “Publications and Services” at the top of the page and then “SDB-Statistical Database” on the left-hand side of the screen and “barrier free log-in” among the log-in options. This will take you to

<http://sdb.statistik.at/superweb/login.do?guest=guest&product=w3c>

which gives you the option of selecting one of many available databases. Among these, choose the following to access the data of interest:

- Labor market: Austrian Micro census - Labour Force Survey Yearly Data
- Population: Population Censuses: Register Based Census: Register Based Labour Market Statistics starting from 2009 at Lander level
- Population: Population Censuses: Population Censuses until 2001: Population census, time series 1971-2001
- Population: Population Censuses: Population Censuses until 2001: Population census data since 1869 by age and Provinces

After choosing an option, scroll to the bottom of the page and hit the “next” button. This will produce an empty table. To select the information you need, press on “edit the table” at the upper left-hand corner of the screen. Once you are finished building the table, you can download the results in Excel and other formats.

#### *Estimation and fill-in procedure*

- For 1961 we construct a backward projection using the detailed age breakdown available in the 1971 census (which breaks down the population by 5-year intervals until the age of 95) and the observed age structure of the 25+ population in 1961. We interpolate or extrapolate linearly to complete the series in years finished in 0 and 5 between 1960 and 2010.

- *Breakdown of  $L1+L2.1$* : We have an observation for  $L1$  in 1995, based on microcensus data (LFS) for the population 25-64 (provided by Statistics Austria for the previous version of this paper). This source puts  $L1$  at 0.71 in 1995, with  $L1+L2.1 = 36.2$ , which is consistent with our other data.

To approximate the time profile of  $L1$ , we use the observed value of the ratio  $L1/(L1+L2.1)$  in West Germany. For 1990 onward, we prolong the West German series of this ratio using the growth rate of the same variable for unified Germany. We apply this series to the observed value of  $L1+L2.1$  in Austria to recover a preliminary estimate of  $L1$ . Since this estimate is much higher than the observed value of  $L1$  in 1995, we disregard its levels, but keep its time profile. That is, we keep our direct observation for  $L1$  in 1995 and complete the series moving both backward and forward from this year using the growth rates of the auxiliary  $L1$  series constructed as indicated above.

**Table A.2: Summary of data sources and fill-in procedure for Austria**

<i>level</i>	1960	1961	1965	1970	1971	1975	1980	1981
<i>L1</i>	est		est	est		est	est	
<i>L2.1</i>	est		est	est		est	est	
<i>L1+L2.1</i>	ext	<b>BP</b>	int	int	<b>C</b>	int	int	<b>C</b>
<i>L2.2</i>	ext	<b>BP</b>	int	int	<b>C</b>	int	int	<b>C</b>
<i>L3.1</i>	ext	<b>BP</b>	int	int	<b>C</b>	int	int	<b>C</b>
<i>L3.2</i>	ext	<b>BP</b>	int	int	<b>C</b>	int	int	<b>C</b>
<i>level</i>	1985	1990	1991	1995	2000	2001	2005	2010
<i>L1</i>	est	est		<b>S</b>	est		est	est
<i>L2.1</i>	est	est		<b>S</b>	est		est	est
<i>L1+L2.1</i>	int	int	<b>C</b>	int	int	<b>C</b>	<b>S</b>	<b>S</b>
<i>L2.2</i>	int	int	<b>C</b>	int	int	<b>C</b>	<b>S</b>	<b>S</b>
<i>L3.1</i>	int	int	<b>C</b>	int	int	<b>C</b>	<b>S</b>	<b>S</b>
<i>L3.2</i>	int	int	<b>C</b>	int	int	<b>C</b>	<b>S</b>	<b>S</b>

- Note: See the discussion surrounding Table A.1 in the Australia section.

### 3. Belgium

#### *Structure of the system*

Since 1983, schooling is mandatory on a full-time basis for children between 6 and 15 years of age and on a part-time basis until the age of 18. Primary school lasts for 6 years, starting at the age of six, and is followed by three years of lower secondary education. Starting in the last year of this cycle, students choose among several alternative itineraries. Some of them prepare them for higher education and the rest provide vocational qualifications. Upper secondary schooling generally lasts for 3 years (4 in some cases). Higher education is provided by universities, which traditionally offer long courses of at least 4 years (this is changing with the implementation of Bologna) and by other institutions (*Hautes Ecoles* and *Ecoles Supérieures des arts*) which offer both short (2-3 year) and long courses. For further details on the structure of the system, see the 1991 and 2001 census monographs listed below and the following links:

[http://en.wikipedia.org/wiki/Education\\_in\\_Belgium](http://en.wikipedia.org/wiki/Education_in_Belgium)

[http://fr.wikipedia.org/wiki/Éducation\\_en\\_Belgique](http://fr.wikipedia.org/wiki/Éducation_en_Belgique)

<https://webgate.ec.europa.eu/fpfis/mwikis/eurydice/index.php/Belgium-French-Community:Overview>

<https://webgate.ec.europa.eu/fpfis/mwikis/eurydice/index.php/Belgium-Flemish-Community:Overview>

### *Attainment categories*

- The breakdown of *L2.2* into vocational and academic branches can only be approximated in certain years.<sup>6</sup> For those years, students can be classified into four different groups according to the orientation of their curricula (general education, and professional, artistic and technical studies). We have approximated *L2.2ac* by general education and included the other three groups into *L2.2voc*.
- We include in *L2.1* people who have not earned a lower secondary diploma but have stayed in school at least until age 15 or higher.

### *Data sources*

The available data come from the censuses of 1961, 1970, 1981, 1990 and 2000 and from the Labor Force Survey for 2000, 2005 and 2010. Some of this information has been taken from paper sources and from the website of Statistics Belgium and the rest has been provided directly by Statistics Belgium for a previous version of this paper. As indicated below, not all these data are used in our final estimates.

Census data of interest can be found at the following web addresses:

Recensement de la population et des logements de 1981. Monographie 1981 No. 4, Population scolaire et niveau d'instruction. Tableau 11.08A Population de 14 ans et plus ne suivant plus d'enseignement de plein exercice d'après le sexe, le groupe d'âge, le type d'activité et le niveau d'instruction, p. 160.

<http://statbel.fgov.be/fr/statistiques/chiffres/population/recensement/1981/>

Recensement Général de la population et des logements au 1er mars de 1991. Monographie No. 9, Scolarisation, niveau d'instruction et insertion professionnelle. Tableau 3.16: Niveau d'instruction (diplôme le plus élevé obtenu en Belgique au à l'étranger). Population totale de 18 ans et plus ayant quitté l'enseignement de plein exercice, par groupe d'âge, p. 98.

<http://statbel.fgov.be/fr/statistiques/chiffres/population/recensement/1991/>

Enquête socio-economique 2001. Monographie no. 7. Scolarité et emploi. Tableau 2: Niveau de diplôme le plus élevé obtenu selon l'âge et le sexe, p. 41.

<http://statbel.fgov.be/fr/statistiques/chiffres/population/recensement/2001/>

Enquête sur les forces de travail, 1999-2010. Tableau T1.003: Diplôme obtenu, sexe, âge et région de résidence.

[http://statbel.fgov.be/fr/modules/publications/statistiques/marche\\_du\\_travail\\_et\\_conditions\\_de\\_vie/enquete\\_sur\\_les\\_forces\\_de\\_travail\\_1999-2010.jsp](http://statbel.fgov.be/fr/modules/publications/statistiques/marche_du_travail_et_conditions_de_vie/enquete_sur_les_forces_de_travail_1999-2010.jsp)

- *Population of reference*: population 25+ in LFS data for 2000-10 and in the 2001 census; population 25+ who no longer attend school full time for the 1970, 1981 and 1991 censuses. The available data from the 1960 census refers to the population 14+ (out of school?).

### *Problems with early census data and construction of our estimates:*

Table A.3 collects the raw data we have for Belgium. Columns [2] to [6] contain census data for 1961-2001, while columns [7]-[9] are taken from the Labor Force Survey (LFS). The data provided by the

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<sup>6</sup> The 1981 census gives a breakdown of *L2.2* into the four categories. For 2001, the census report tells us that 28,6% of upper secondary graduates followed a general education course (p. 42). We apply this percentage to the upper secondary attainment share given by the 2000 LFS.

census and by the LFS in their common year of 2001 seem to be consistent, although there are noticeable differences in the breakdown of secondary schooling by cycle.

**Table A.3: raw data for Belgium**

	[1] 1961 BP 25+	[2] 1961 census 14+ (out of school?)	[3] 1970 census 25+ (out of school?)	[4] 1981 census 25+ out of school	[5] 1991 census 25+ out of school	[6] 2001 census 25+	[7] 2001 LFS 25+	[8] 2005 LFS 25+	[9] 2010 LFS 25+
<i>No diploma</i>	49.56			36.48		4.37		8.56	7.34
School leaving age unknown or <15	43.69			30.12					
School leaving age 15 or over	5.86			6.36					
Schooling unknown					33.80	6.75			
Primary	27.73			22.68	15.07	17.40		16.28	13.02
<i>Primary + unknown + no diploma</i>	77.28	63.55	75.50	59.16	48.87	28.52	28.60	24.83	20.36
Lower secondary	11.77	14.99	10.62	18.72	16.58	23.35	20.68	18.60	17.91
Upper secondary	6.46	11.90	6.62	12.44	19.39	24.97	27.71	30.61	31.73
<i>Higher education, non-university</i>	2.89	6.32	4.79	6.30	10.55				
short					9.78	13.70	12.42	14.48	15.46
long					0.77		2.69	2.87	4.04
University	1.59	3.24	2.46	3.38	4.61		7.89	8.60	10.50
Non-university long or university						9.45			

As we move back in time, the census data do not always display a plausible profile. If we lump together persons of unknown attainment with those with no diploma or only primary schooling, as the Belgian Statistical Agency tends to do, the raw data would imply a sharp decline in attainment between 1961 and 1970, with a 12-point rise in the lowest attainment category and corresponding declines in all others (which may be due in part to the change in the population of reference, from 14+ to 25+). On the other hand, between 1991 and 2001 we would see the opposite phenomenon, with a 20-point decline in the lowest category that looks rather implausible due to its size and to the fact that it comes entirely from a huge drop in the fraction of the population with unknown attainment.

We hypothesize that these suspicious results are due at least in part to the treatment of and the fluctuations in the size of a large segment of the population whose educational level is not known with precision. In the 1981 census these people are classified as having no diploma, while in 1991 they are considered of “unknown schooling level” and in 2001 a distinction is made between the two groups, with their overall size dropping dramatically from over 1/3 of the population to 10%.

As an additional reference for the beginning of the sample period, column [1] shows a crude estimate of attainment levels in 1961 constructed by backward projection using data from the 1981 census, which only provides a rather coarse breakdown of the population by age group (25-44, 45-64 and 65+). Since we cannot isolate precisely the 65+ age group in each quinquennium (which is the one that would need adjustment for differential survival probabilities by attainment categories) the correction

for this factor is even rougher than in other cases. We have adjusted for differential mortality the attainment shares of the population aged 65+ in 1981 using the procedure sketched in the text and in the case of Australia. However, since this group include many individuals who are younger than 65 during most of the transition period, we multiply by 0,5 Barro and Lee's estimates of  $\rho_L$  and  $\rho_H$ . Since these are qinquennial rates, moreover, the 1961 attainment shares of the cohort that was 65+ in 1981 would be approximated by

$$(A.3) \hat{h}_{j1961}^{45+} = \frac{h_{j1981}^{65+}}{(1 - 0.5 * \hat{\rho}_j)^4}$$

where we apply the low schooling coefficient,  $\rho_L$ , to all attainment categories below a lower secondary diploma.<sup>7</sup>

Comparing column [1] of Table A.1 to columns [2] and [3] leads us to disregard column [2] as too optimistic to provide a credible estimate of 25+ attainment in 1961. Similarly, if the error in our backward projection is not very large, most of the figures for 1970 in column [3] are probably too pessimistic, as they would imply an implausible drop in secondary attainment and an increase in the size of the lowest attainment category. The exception would be the figures for higher attainment, which seem consistent both with the 1961 backward projection and with the results of the 1981 census (and may be unaffected by the misallocation of the unknown attainment group). Hence, we will disregard entirely the original census data for 1961 and partially that for 1970, keeping only the reported attainment for higher education in this year. We will use the backward projection of the 1981 census as our estimate for 1961.

The 1981 census gives us a useful piece of data that we will use to make an adjustment to the raw data, namely, some information on the school-leaving age of those classified as having earned no diplomas. While most of them have left school at the age of 14 at the latest, a non-negligible fraction of them (over 17%) remained in school until age 15 or higher. Even allowing for repetitions, it seems unlikely that this group has not progressed beyond primary schooling. Hence, we will assign to it lower secondary attainment, including the remaining 83% in *L1*. This can be done directly in 1981 and 1961 (using our backward projection). For 1991 we will apply the 1981 percentage given above to the total number of people with unknown attainment to estimate the part of this group that has attained lower secondary education, and assign the rest to the primary or lower attainment group. Finally, we disregard the 2001 census and replace it with LFS data for the year 2000.

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<sup>7</sup> A problem with our backward projection is that it does not take into account immigration between 1961 and 1981, which was significant in Belgium and predominantly low-skilled. We have checked, however, that the resulting bias is likely to be very small. According to the 1981 census, in that year there were in Belgium around 187,000 foreign nationals aged 45 and over, which represented 5.1% of the total population of that age group (which is the one used in our backward projection). The educational attainment of foreigners is not known, but a rough estimate can be used to check the sensitivity of our results to immigration. We assume, in particular, that secondary attainment shares among foreigners were 50% of those of Belgians and that no foreigners had a university degree. Subtracting the resulting figures from the total to approximate the educational attainment of Belgians, we find that average years of schooling goes down by only 0.66% with the correction.

**Table A.4: refined data for Belgium**

	1961	1971	1981	1991	2000	2005	2010
	<i>BP</i>	<i>census</i>	<i>census</i>	<i>census</i>	<i>LFS</i>	<i>LFS</i>	<i>LFS</i>
<i>L1</i>	71.42		52.80	42.98	28.88	24.83	20.36
<i>L2.1</i>	17.64		25.08	22.47	21.16	18.60	17.91
<i>L2.2</i>	6.46		12.44	19.39	27.45	30.61	31.73
<i>L3.1</i>	2.89	4.79	6.30	9.78	12.34	14.48	15.46
<i>L3.2</i>	1.59	2.46	3.38	5.38	10.16	11.47	14.54

- *Note:* whenever possible *L3.1* is identified with non-university short and *L3.2* with the sum of university and non-university long. For 1961 and 1981 *L3.1* is identified with non-university, which is not disaggregated into short and long cycles. In these years, however, long non-university courses seem to have been relatively rare (as the first disaggregated observation, for 1991, suggests).

Our final estimates are obtained by linear interpolation and extrapolation using the refined observations given in Table A.4. For 1971 we respect the higher education attainment figures and estimate the remaining categories by interpolating their shares in non-higher attainment between 1961 and 1981. Estimates for 1960 are constructed by backward extrapolation using data for 1961 and either 1970 or 1981.

**Table A.5: Summary of data sources and fill-in procedure for Belgium**

	1960	1961	1965	1970	1975	1980	1981
<i>L1</i>	ext	<b>BP</b>	int	int	int	int	<b>C</b>
<i>L2.1</i>	ext	<b>BP</b>	int	int	int	int	<b>C</b>
<i>L2.2</i>	ext	<b>BP</b>	int	int	int	int	<b>C</b>
<i>L3.1</i>	ext	<b>BP</b>	int	<b>C</b>	int	int	<b>C</b>
<i>L3.2</i>	ext	<b>BP</b>	int	<b>C</b>	int	int	<b>C</b>
	1985	1990	1991	1995	2000	2005	2010
<i>L1</i>	int	int	<b>C</b>	int	<b>S</b>	<b>S</b>	<b>S</b>
<i>L2.1</i>	int	int	<b>C</b>	int	<b>S</b>	<b>S</b>	<b>S</b>
<i>L2.2</i>	int	int	<b>C</b>	int	<b>S</b>	<b>S</b>	<b>S</b>
<i>L3.1</i>	int	int	<b>C</b>	int	<b>S</b>	<b>S</b>	<b>S</b>
<i>L3.2</i>	int	int	<b>C</b>	int	<b>S</b>	<b>S</b>	<b>S</b>

- *Note:* See the discussion surrounding Table A.1 in the Australia section.

#### 4. Canada

##### *Structure of the system*

The structure of the system varies across provinces. Education is mandatory in most provinces until the age of 16 (18 in a few of them). School education typically comprises 12 grades<sup>8</sup> broken down into three stages: primary or elementary school typically lasts for 5 or 6 years; it is followed by middle school or junior high school which lasts until grade 8 or 9 and by high school or senior high until

<sup>8</sup> In Quebec, high school finishes at grade 11 but a two-year preparatory college (CEGEP) program is required for university admission.

grade 12. After leaving school, students can attend colleges and institutes that generally offer vocational qualifications (certificates after a year and diplomas after 2 or 3 years) or universities that offer longer academic programs leading to a bachelors degree (generally after 4 years) and then to graduate degrees. There are also apprenticeship programs that typically last for 4 years and include part-time classroom training. At least in some provinces (including Quebec), students can enter basic vocational training without having completed upper secondary education.

For further details see for instance

<http://www.ibe.unesco.org/en/worldwide/unesco-regions/europe-and-north-america/canada/profile-of-education.html>

[http://en.wikipedia.org/wiki/Education\\_in\\_Canada](http://en.wikipedia.org/wiki/Education_in_Canada)

<http://www.cicic.ca/421/an-overview.canada>

<http://www.cicic.ca/444/provinces-and-territories.canada>

- *Other links of interest:* Notes on the comparability of the 2006 census data on education with that of earlier censuses

2006 Census reference materials. Reference guides and technical reports. Education reference guide.

<http://www12.statcan.gc.ca/census-recensement/2006/ref/rp-guides/education-eng.cfm>

#### **Data Sources:**

Statistics Canada has provided us with data on *L1+L2.1*, *L2.2*, *L3.1* and *L3.2* at five-year intervals between 1971 and 1996 and with additional observations for *L1+L2.1*, *L2.2+L3.1* and *L3.2* for 1951 and 1961. These data are shown in Table A.6. We use additional census and LFS data taken from the website of Statistics Canada and from the UNESCO Yearbook. We work with the population 25+ in all cases.

2006 Census. Data Products. Topic-based tabulations. Education. Highest certificate, diploma or degree. Highest Certificate, Diploma or Degree, Age Groups and Sex for the Population 15 Years and Over.

<http://www12.statcan.gc.ca/census-recensement/2006/dp-pd/tbt/Lp-eng.cfm?LANG=E&APATH=3&DETAIL=1&DIM=0&FL=A&FREE=0&GC=0&GID=0&GK=0&GRP=1&PID=0&PRID=0&PTYPE=88971,97154&S=0&SHOWALL=0&SUB=755&Temporal=2006&THEME=75&VID=0&VNAMEE=&VNAMEF=>

2001 Census. Data Products. Topic-based tabulations. Education in Canada: School attendance and levels of schooling. Detailed Highest Level of Schooling, Age Groups and Sex for Population 15 Years and Over.

<http://www12.statcan.gc.ca/english/census01/products/standard/themes/Rp-eng.cfm?LANG=E&APATH=3&DETAIL=0&DIM=0&FL=A&FREE=0&GC=0&GID=0&GK=0&GRP=1&PID=55457&PRID=0&PTYPE=55430,53293,55440,55496,71090&S=0&SHOWALL=0&SUB=0&Temporal=2001&THEME=51&VID=0&VNAMEE=&VNAMEF=>

Online database CANSIM. Education, training and learning. Labour Force Survey estimates (LFS), by educational attainment, sex and age group, annual (Persons), 1990 to 2011.

<http://www5.statcan.gc.ca/cansim/a33?RT=TABLE&themeID=1825&spMode=tables&lang=eng>

**Table A.6: Data supplied by Statistics Canada,  
Educational attainment of the population 25+**

	1961*	1971	1976	1981	1986	1991	1996
LESS THAN GRADE 9	48.8	37.76	31.97	24.90	20.64	16.12	13.85
GRADES 9 TO 13 WITHOUT SEC GRAD			26.12	22.54	23.16	20.86	18.99
SECONDARY GRADUATION ONLY			10.66	11.41	11.80	14.12	14.09
GRADES 9-13 WITH & WITHOUT SEC GRAD	47.8	34.58	36.78	33.94	34.96	34.98	33.07
TRADES CERTIFICATE OR DIPLOMA		6.32		3.72	3.32	4.46	4.22
<i>Subtot: Elem.-Sec. Only</i>		78.66	68.75	62.56	58.92	55.56	51.15
OTH NON-U: without NON-U OR TRADES CERT.		4.64	6.41	5.26	6.23	5.97	5.82
OTH NON-U: WITH TRADES CERT. OR DIPL.		6.23		7.30	6.82	7.02	6.90
OTH NON-U: WITH NON-UNIV. CERT. OR DIPL.			8.68	7.63	8.70	10.07	12.45
<i>Subtot: Other Non-univ. Educ. Only</i>		10.87	15.10	20.19	21.74	23.06	25.17
UNIV. without CERT † DIP † DEG		2.48	3.56	2.88	3.16	3.17	3.01
UNIV. WITH UNIV † OTH NON-U CERT OR DIP		2.65	5.04	4.79	5.11	5.37	5.80
BACHELOR		2.59	5.36	7.14	8.30	9.62	11.13
MEDICINE		1.40	0.47	0.48	0.47	0.51	0.55
MASTER'S			1.34	1.56	1.87	2.23	2.63
PHD			0.38	0.40	0.43	0.48	0.55
MASTER'S AND PHD		1.35	1.72	1.96	2.30	2.71	3.19
<i>SUBTOT: UNIVERSITY</i>	3.4	10.47	16.15	17.24	19.33	21.38	23.68

(\*) Data for 1961 comes from a different source and is compiled using different criteria. In particular, since "university" seems to refer to those who have completed a long degree, "grades 9 to 13" would correspond to L2.2+L3.1.

#### *Attainment categories*

- We include in L3.2 those who have obtained a Bachelors or higher university degree, and in L3.1 other non-university higher education, shorter degrees and university attendance without a degree. For L1+L2.1 we use data on less than grade 9 achievement, and for L2.2 the sum of grades 9-13 (with and without secondary graduation) and secondary-level trades certificates or diplomas (see below).

#### *Estimation and fill-in procedure*

- For 1961 we use UNESCO data for L3 and estimate L3.1 as the difference between the UNESCO L3 figure and the L3.2 reading provided by Statistics Canada. We then subtract from the reported figure for L2.2+L3.1 our estimate of L3.1 to obtain L2.2.

- In most years, Statistics Canada does not report L2.1, which is grouped together with L1 as a single category (less than grade 9). For 2001, however, we have data for the number of people who have completed 4 or less grades, which we will identify with L1, disaggregated by 5-year age groups. We calculate the ratio  $L1/(L1+L2.1)$  for the different age groups (defined as those with X years of age or more) and assign the value observed for the 30+ group to 1996, for the 35+ age group to 1991 and so on until we reach the 65+ group, which is assigned to 1961. Since the value of the ratio  $L1/(L1+L2.1)$  is

roughly constant over time, we assume that it remains so after 2001 and assign the value observed in that year to 2005 and 2010.

- *Trade qualifications*: In the data provided by Statistics Canada for 1971-96, trade qualifications seem to be split into two parts, one of which is included in secondary education (*L2.2*) and the other one in post-secondary (*L3.1*). In census data taken from the Statistics Canada Web this distinction disappears and a single grouping is used for all “trades certificates or diplomas.” To preserve the homogeneity of the series, we apply the weight of secondary trades programs in the total observed in 1996 (0.38) to the total weight of trade qualifications according to the 2001 census to split this item into two parts: one to be included in *L2.2* and the other in *L3.1*.

- We interpolate to fill in missing observations and to estimate values at five-year intervals starting in 1960 rather than in 1961 and ending in 1995. For *L2.2* and *L3.1*, we use the 1961 and 1971 observations or estimates to extrapolate back to 1960. For *L1+L2.1* and *L3.2* we interpolate between 1951 and 1961. For 2001 we use census data for that year.

**Table A.7: Summary of data sources and fill-in procedure for Canada**

	1951	1960	1961	1965	1970	1971	1975	1976	1980	1981
<i>L1</i>		est	<b>est</b>	int	int	<b>est</b>	int	<b>est</b>	int	<b>est</b>
<i>L2.1</i>		est	<b>est</b>	int	int	<b>est</b>	int	<b>est</b>	int	<b>est</b>
<i>L1+L2.1</i>	Nat	int	<b>Nat</b>	int	int	<b>Nat</b>	int	<b>Nat</b>	int	<b>Nat</b>
<i>L2.2</i>		ext	<b>Nat</b>	int	int	<b>Nat</b>	int	<b>Nat</b>	int	<b>Nat</b>
<i>L3</i>			<b>Une</b>							
<i>L3.1</i>		ext	<b>dif</b>	int	int	<b>Nat</b>	int	<b>Nat</b>	int	<b>Nat</b>
<i>L3.2</i>	Nat	int	<b>Nat</b>	int	int	<b>Nat</b>	int	<b>Nat</b>	int	<b>Nat</b>
	1985	1986	1990	1991	1995	1996	2000	2001	2005	2010
<i>L1</i>	int	<b>est</b>	int	<b>est</b>	int	<b>est</b>	int	<b>C</b>	<b>est</b>	<b>est</b>
<i>L2.1</i>	int	<b>est</b>	int	<b>est</b>	int	<b>est</b>	int	<b>C</b>	<b>est</b>	<b>est</b>
<i>L1+L2.1</i>	int	<b>Nat</b>	int	<b>Nat</b>	int	<b>Nat</b>	int	<b>C</b>	<b>Pr S</b>	<b>Pr S</b>
<i>L2.2</i>	int	<b>Nat</b>	int	<b>Nat</b>	int	<b>Nat</b>	int	<b>C</b>	<b>Pr S</b>	<b>Pr S</b>
<i>L3.1</i>	int	<b>Nat</b>	int	<b>Nat</b>	int	<b>Nat</b>	int	<b>C</b>	<b>Pr S</b>	<b>Pr S</b>
<i>L3.2</i>	int	<b>Nat</b>	int	<b>Nat</b>	int	<b>Nat</b>	int	<b>C</b>	<b>Pr S</b>	<b>Pr S</b>

- *Note*: See the discussion surrounding Table A.1 in the Australia section.

- Data from the 2006 census are not comparable to those from earlier censuses. At the lower end of the educational distribution, the lowest attainment category reported includes all those who have not obtained a high school graduation certificate. This includes people who have started high school (grades 9 to 12) but not completed it or obtained a certificate, whom we included in *L2.2* in previous years. At the upper end of the distribution, no data are provided on those who have some post-secondary training but no formal post-secondary certificate or diploma.

As a result, we have disregarded the 2006 census data and worked with data from the Labor Force Survey, which provides a breakdown of the population by attainment levels that is closer to that of previous censuses (except for the fact that it includes all trade qualifications in post-secondary). The

growth rates of the different attainment shares reported in the LFS between 2001 and 2005 and between 2001 and 2010 are used to project forward our census-based estimates of 2001 attainment shares. The estimates obtained in this manner are then rescaled proportionately so that they add up to 100%.  $L1+L2.1$  is split into its two components using the observed value of the  $L1/(L1+L2.1)$  ratio in 2001.

## 5. Denmark

### *Structure of the system*

Education is mandatory between 6 and 16 years of age. Students in this age group attend *Folkeskole* or basic schools until 9<sup>th</sup> grade (or an optional 10<sup>th</sup> grade). Upper secondary schools typically last for 3 years, until grade 12, and come in various types: academically-oriented general upper secondary schools (Gymnasium and higher preparatory examination programs), vocationally-oriented general upper secondary schools and vocational schools, which also offer apprenticeship programs. Higher education programs are of three types depending on their duration: short-cycle programs of up to 2 years are mostly vocational in nature, middle-cycle programs last between 2 and 4 years and include nurse and teacher training courses, and long cycle programs (including bachelors degrees) take four years or more to complete.

For additional details, see

<https://webgate.ec.europa.eu/fpfis/mwikis/eurydice/index.php/Denmark:Overview>

[http://en.wikipedia.org/wiki/Education\\_in\\_Denmark](http://en.wikipedia.org/wiki/Education_in_Denmark)

Statistical Yearbook 2010. Education and culture.

<http://www.dst.dk/pukora/epub/upload/15198/sy2010.pdf>

### *Data sources*

We use data taken from the website of Statistics Denmark which ultimately come for the Attainment Register. For 1983 they are taken from the 1985 Statistical Yearbook. For 1991, 1995, 2000, 2005 and 2010 from the *Statbank* online database. We also use OECD (1974) for attainment growth rates between 1960 and 1971 that are used to project attainment back to the start of the sample period.

Statistics Denmark website: Statbank: Subjects: Education: Education and Employment (including discontinued tables). Highest attained education of the population 16-69, 2006-2011.

<http://www.statbank.dk/statbank5a/default.asp?w=1440>

Statistics Denmark website: Statbank: Subjects: Education: Education and Employment: Discontinued Tables. Highest attained education of the population 16-69, 1991-2006.

<http://www.statbank.dk/statbank5a/default.asp?w=1440>

Statistics Denmark website. Statistical Yearbook. Earlier Editions.

<http://www.dst.dk/en/Statistics/ofs/Publications/Yearbook/yearbooks.aspx>

starting page for Statbank:

<http://www.statbank.dk/statbank5a/default.asp?w=1440>

The data we use refer to the 25-69 age group, except in 1983 when it is 25-62.

#### *Attainment categories and estimation and fill in procedure*

- Short and medium cycle post-secondary studies are included in *L3.1*. Bachelor degrees and long-cycle university studies are included in *L3.2*.
- Data for 1991 and later years are taken directly from the *Statbank* database for all attainment categories. The *Statbank* series has a break in 2006 that involves the cutoff point for low schooling we identify with primary attainment (*L1*). For 1991-2006, it provides data on the population with between 1 and 7 years of schooling and for 2006-11 the cutoff point drops to 6 (or less) years of schooling. For 2006 both series are available. We have extended the more recent *L1* series (1 to 6 years) backward to 1991 using the growth rate of the older series.
- Data for 1983 are taken from the 1985 Statistical Yearbook. Figures for 1973 are a backward projection using attainment data broken down by age group in 1983 and the age structure of the population in 1971 (the closest year we could find). The 1983 disaggregation by age stops with the group 60-62. In order to have a five-year age bracket to work with, as in the rest of the cases, we estimate attainments for the 63-64 population by extrapolating the change between the previous two age groups and weighting it for the length of the age brackets, and reconstruct attainment for the 60-64 age segment. Then we extrapolate backwards again from consecutive age groups of the same length until we reach the age of 74 in 1983, which allows us to reconstruct the population 25 to 64 in 1973. For this calculation we assume that, at each step, the change in the achievement ratios for each category drops to one half.
- Using the 1973 and 1983 observations/projections for *L2.2*, *L3.1* and *L3.2* we extrapolate back to 1970. Finally, we use the annual growth rate of attainment between 1960 and 1971 reported in OECD (1974) to estimate the 1960 values of these attainment shares. (We use the growth rate of attainments, which is recovered from the original data on average years of schooling by level. It coincides with the original for *L3* but not for *L2.2* since people with university schooling also have secondary training and we have to subtract them from the total to get those whose maximum attainment level is secondary).
- We correct for the fact that the data for 1983 (and implicitly our estimates for earlier years based on it) refer to a younger age group than the data for 1991 onward. Using data for 1991 broken down by age group, we estimate the percentage difference between the attainment shares for the higher educational levels (*L2.2*, *L3.1* and *L3.2*) in the 25-69 and the 25-64 age groups, which we multiply by 1.4 to approximate the correction required to go from the 25-62 age group to the 25-69 age group. Finally, we fill in missing observations (in 1965, 1970, 1975, 1980, 1985 and 1990) by linear interpolation between our estimates for 1960, 1970, 1973, 1983 and the 1991 observation.

- In the 1983 data, *L1* and *L2.1* are reported together. To complete the *L1* series, we extrapolate back linearly to 1990 using the 1991 and 1995 observations and then extend the series back to 1960 using the growth rates of *L1* in Norway. *L2.1* is then adjusted so that attainment shares add up to 100%.

- When computing the share of the population with each level of attainment, we disregard the "not stated" category, which is rather small (around 2.5% of the population in recent years). This procedure, which is equivalent to imputing them to all attainment levels in proportion to their weight in those for whom there is no information, is consistent with the recommendation of the Danish Statistical Office.

- To approximate *L2.2voc* in some years before 1991, we interpolate the ratio *L2.2voc/L2.2* using the 1973, 1983 and 1991 observations or projections and apply the resulting ratio to the observed or estimated value of *L2.2* in 1975, 1980, 1985 and 1990.

**Table A.8: Summary of data sources and fill-in procedure for Denmark**

	1960	1965	1970	1973	1975	1980	1983
<i>L1</i>	est	est	est	est	est	est	est
<i>L2.1</i>	est	est	est	est	est	est	est
<i>L1+L2.1</i>	est	int	ext	<b>BP</b>	int	int	<b>R</b>
<i>L2.2</i>	est	int	ext	<b>BP</b>	int	int	<b>R</b>
<i>L3.1</i>	est	int	ext	<b>BP</b>	int	int	<b>R</b>
<i>L3.2</i>	est	int	ext	<b>BP</b>	int	int	<b>R</b>
	1985	1990	1991	1995	2000	2005	2010
<i>L1</i>	est	ext	<b>R</b>	<b>R</b>	<b>R</b>	<b>R</b>	<b>R</b>
<i>L2.1</i>	est	ext	<b>R</b>	<b>R</b>	<b>R</b>	<b>R</b>	<b>R</b>
<i>L1+L2.1</i>	int	ext	<b>R</b>				
<i>L2.2</i>	int	int	<b>R</b>	<b>R</b>	<b>R</b>	<b>R</b>	<b>R</b>
<i>L3.1</i>	int	int	<b>R</b>	<b>R</b>	<b>R</b>	<b>R</b>	<b>R</b>
<i>L3.2</i>	int	int	<b>R</b>	<b>R</b>	<b>R</b>	<b>R</b>	<b>R</b>

- Note: See the discussion surrounding Table A.1 in the Australia section.

## 6. Finland

### *Structure of the system*

Schooling typically starts at age 6 with a year of kindergarten or pre-school followed by a mandatory 9-year course at a comprehensive basic school that includes six years of primary schooling and three of lower secondary education.<sup>9</sup> Post-compulsory (upper) secondary schooling generally lasts for three years. Students can choose between an academic and a vocational track. Higher education institutions are divided into universities and polytechnics. Universities generally offer longer and more

<sup>9</sup> Up until the early 1970s compulsory schooling was provided in 7-year civic schools. After grade 4, some students moved into grammar schools, where they followed two cycles of lower and upper secondary education lasting 5 and 3 years respectively.

academically oriented programs, while polytechnics are oriented toward technical and vocational training. For additional details see for instance:

<https://webgate.ec.europa.eu/fpfis/mwikis/eurydice/index.php/Finland:Overview>

[http://en.wikipedia.org/wiki/Education\\_in\\_Finland](http://en.wikipedia.org/wiki/Education_in_Finland)

<http://www.euroeducation.net/prof/finco.htm>

[http://www.oph.fi/english/education/overview\\_of\\_the\\_education\\_system](http://www.oph.fi/english/education/overview_of_the_education_system)

<http://www.minedu.fi/OPM/Koulutus/koulutusjaerjestelmae/?lang=en>

Antikainen, A. and A. Luukkainen. "Twenty- five Years of Educational Reform Initiatives in Finland." Department of Sociology, University of Joensuu, Finland.

[https://docs.google.com/viewer?a=v&q=cache:NW7wrxDQqykJ:cc.joensuu.fi/~anti/publ/uudet/twenty\\_five\\_years.pdf+Finland+comprehensive+education&hl=en&gl=us&pid=bl&srcid=ADGEEShyRLWPX81y0udhExBjjNgZNoOrvE2rXQOvNKqTZ4z7e0ZO1VpGmK9NqH9B9XR0yqZG\\_0wrZeyKNeicmAeMPIOSF1cR--W4dI-jXpBovJkFAKH-k7KpCRmj4O3wKBR5qCXeKaci&sig=AHIEtbO9VORHloF3tYEMneV7C7InXW3Ysw&pli=1](https://docs.google.com/viewer?a=v&q=cache:NW7wrxDQqykJ:cc.joensuu.fi/~anti/publ/uudet/twenty_five_years.pdf+Finland+comprehensive+education&hl=en&gl=us&pid=bl&srcid=ADGEEShyRLWPX81y0udhExBjjNgZNoOrvE2rXQOvNKqTZ4z7e0ZO1VpGmK9NqH9B9XR0yqZG_0wrZeyKNeicmAeMPIOSF1cR--W4dI-jXpBovJkFAKH-k7KpCRmj4O3wKBR5qCXeKaci&sig=AHIEtbO9VORHloF3tYEMneV7C7InXW3Ysw&pli=1)

### ***Data Sources***

For 1970-2010 we use data on the educational attainment of the population 25+ provided by Aila Repo of Statistics Finland. These data are obtained from the Register of Completed Education and Degrees. We use the detailed breakdown by age group provided in this source to construct backward projections for 1965 and 1960. We also use data from UNESCO on *L2*, interpreted as *L2.2* for 1960, from the DYB for *L2* in 1960 and from EAG (2010) for *L1* in 2008.

Data on educational attainment (but only for the 15+ population) and on the age structure of the population can be downloaded from the online database Statfin at

[http://pxweb2.stat.fi/database/StatFin/databasetree\\_en.asp](http://pxweb2.stat.fi/database/StatFin/databasetree_en.asp)

### ***Estimation and fill in procedure and attainment categories***

- *Backward projections for 1960 and 1965:* Statistics Finland has provided data for 1970 broken down by 5-year brackets between ages 25 and 85 and an open ended upper interval of 85 and above (85+). We take the attainment shares of these age groups back to 1965 and 1960, leaving 80+ as the last group in 1965 and 75+ as the last group in 1960. The attainment levels of the different age groups are then weighted by the actual share of each age group in the total 25+ population in the year of interest to calculate the attainment shares of the 25+ population. We correct for the effect of educational attainment on survival probabilities in the usual way, i.e. using Barro and Lee's estimates of OECD relative survival factors for the population 65+. We apply the low schooling relative survival factor to people with basic schooling and the high-schooling factor to the rest of the population.

- Statistics Finland does not break down comprehensive school attainment into *L1* and *L2.1*. To estimate the breakdown of *L1+L2.1* into its two components, we proceed as follows. For 1960, we estimate *L2.1* as the difference between the *L2* in DYB and the Unesco observation for *L2* that we interpret as *L2.2* and recover *L1* as the difference between our backward projection estimate of *L1+L2.1* and the estimate of *L2.1* just described. For 2008, we take the primary attainment share from EAG

2010. We then interpolate *L1* between 1960 and 2008 and extrapolate forward to 2010 and recover *L2.1* as a residual using our data on *L1+L2.1*.

- The available data on upper secondary attainment are not disaggregated into academic and vocational tracks.

**Table A.9: Summary of data sources and fill-in procedure for Finland**

	1960	1965	1970	1975	1980	1985	1990	1995	2000	2005	2008	2010
<i>L1</i>	dif	int	int	int	int	int	int	int	int	int	<b>EAG</b>	ext
<i>L1+L2.1</i>	<b>BP</b>	<b>BP</b>	<b>R</b>		<b>R</b>							
<i>L2</i>	DYB											
<i>L2.1</i>	dif	dif	dif	dif	dif	dif	dif	dif	dif	dif	dif	dif
<i>L2.2</i>	<b>BP</b>	<b>BP</b>	<b>R</b>		<b>R</b>							
<i>L3.1</i>	<b>BP</b>	<b>BP</b>	<b>R</b>		<b>R</b>							
<i>L3.2</i>	<b>BP</b>	<b>BP</b>	<b>R</b>		<b>R</b>							

- Note: See the discussion surrounding Table A.1 in the Australia section.

## 7. France

### *Structure of the system*

Elementary school (*école élémentaire*) and the first cycle of secondary education (*collège*) are mandatory (since 1959, when the minimum school leaving age was raised from 14 to 16). Primary education lasts for 5 years, starting at age 6, and the first cycle of secondary school lasts for 4 additional years. It is followed by the second cycle of secondary (with a duration of 3 years), which is imparted in high schools or *lycées*. These are classified into general, technological or professional schools. The first two provide academically-oriented training generally leading to the *Baccalauréat* diploma (*BAC*), while the last type of *lycée* provides vocational training, generally leading to vocational qualifications such as *BEP* and *CAP* (*Brevet d'Enseignement Professionnel* and *Certificat d'Aptitude Professionnel* respectively) after 2 years and to the *Bac professionnel* after 3. The *BAC* is required to enter university, which offers a bachelors degree (*licence*), generally after 3 years of study, and a masters degree after 2 additional years. Students can also remain at the *lycée* after obtaining the *Bac* in order to pursue additional specialization courses that typically last for two years. Some of these courses prepare students to apply for entrance into *Grands Ecoles*, a peculiar sort of elite universities, and others lead to professional qualifications such as the *BTS* (*Brevet Technicien Supérieur*).

- In addition to the diplomas mentioned in the previous paragraph, there are two other official diplomas of interest. The *CEP* (*Certificat d'Etudes Primaires*) marked the successful end of primary education but has been suppressed in 1989. The *Brevet des Collèges* (previously *BEPC* or *Brevet d'Etudes du Premier Cycle du Second Degree*) can be obtained at the end of the first cycle of secondary education. However, sitting for the *Brevet* is not mandatory and the diploma is not required to enter *lycée*.

- For additional details see

<https://webgate.ec.europa.eu/fpfis/mwikis/eurydice/index.php/France:Overview>

[http://en.wikipedia.org/wiki/Education\\_in\\_France](http://en.wikipedia.org/wiki/Education_in_France)

[http://fr.wikipedia.org/wiki/Education\\_en\\_France](http://fr.wikipedia.org/wiki/Education_en_France)

<http://about-france.com/primary-secondary-schools.htm>

### *Data sources*

We use data for the 25+ population not enrolled full time in school taken from the censuses of (1960), 1968, 1975, 1982, 1990, 1999 and 2008 and the Labor Force Survey for 2008 and 2010. Attainment data from the last two censuses and the LFS and a reconstructed homogeneous census series starting in 1968 are available online at the web page of INSEE. The distribution of the population by age group in years of interest is also available online and is used in certain calculations. The data refer to metropolitan France, excluding the overseas departments.

Résultats du recensement de la population 1999. France-métropolitaine Population de 15 ans ou plus par sexe et âge selon le diplôme.

[http://www.recensement-1999.insee.fr/default.asp?asp\\_action=liste\\_produit&c\\_nivgeo=F&c\\_codgeo=2&c\\_theme=FOR](http://www.recensement-1999.insee.fr/default.asp?asp_action=liste_produit&c_nivgeo=F&c_codgeo=2&c_theme=FOR)

Résultats du recensement de la population 1999. France-métropolitaine Population de 15 ans ou plus par sexe et âge selon le niveau d'études.

[http://www.recensement-1999.insee.fr/default.asp?asp\\_action=liste\\_produit&c\\_nivgeo=F&c\\_codgeo=2&c\\_theme=FOR](http://www.recensement-1999.insee.fr/default.asp?asp_action=liste_produit&c_nivgeo=F&c_codgeo=2&c_theme=FOR)

Résultats du recensement de la population - 2008. Population non scolarisée de 15 ans ou plus par sexe, âge et diplôme le plus élevé. France métropolitaine.

<http://www.recensement.insee.fr/tableauxDetailles.action?zoneSearchField=FRANCE&codeZone=1-FE&idTheme=7&idTableauDetaille=21&niveauDetail=1>

Données harmonisées des recensements de la population 1968-2008. Population des 16 ans ou plus selon le niveau de diplôme, le sexe et l'âge de 1968 à 2008

[http://www.insee.fr/fr/themes/detail.asp?reg\\_id=99&ref\\_id=pop-17ans-dipl](http://www.insee.fr/fr/themes/detail.asp?reg_id=99&ref_id=pop-17ans-dipl)

Données harmonisées des recensements de la population 1968-2008. Population selon le sexe et l'âge quinquennal de 1968 à 2008.

[http://www.insee.fr/fr/themes/detail.asp?reg\\_id=99&ref\\_id=pop-sexe-age-quinquennal](http://www.insee.fr/fr/themes/detail.asp?reg_id=99&ref_id=pop-sexe-age-quinquennal)

Données harmonisées des recensements de la population 1968-2008. Fichiers detail.

[http://insee.fr/fr/themes/detail.asp?reg\\_id=0&ref\\_id=fd-rp19682008&page=fichiers\\_detail/RP19682008/telechargement.htm](http://insee.fr/fr/themes/detail.asp?reg_id=0&ref_id=fd-rp19682008&page=fichiers_detail/RP19682008/telechargement.htm)

Tableaux de l'économie française. General level of training according to age, 2003 to 2010. (Labor Force Survey).

[http://www.insee.fr/en/themes/tableau.asp?reg\\_id=0&ref\\_id=NATTEF07232](http://www.insee.fr/en/themes/tableau.asp?reg_id=0&ref_id=NATTEF07232)

Population par sexe et groupes d'âges quinquennaux au 1er janvier de l'année, 1991-2012. France métropolitaine.

[http://www.insee.fr/fr/themes/tableau.asp?reg\\_id=0&ref\\_id=NATnon02150](http://www.insee.fr/fr/themes/tableau.asp?reg_id=0&ref_id=NATnon02150)

### *Problems with the census data on education:*

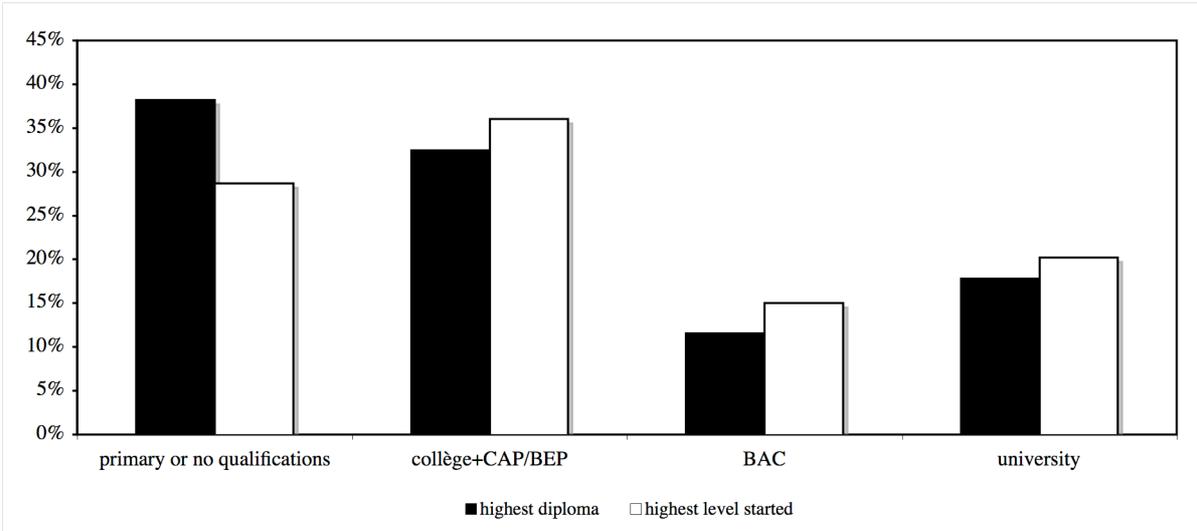
Most census data on educational attainment classifies the population according to the highest diploma obtained. Since the CEP is no longer offered and the *Brevet* is not required, this creates problems,

especially at the lower end of the educational distribution, because many of those listed as having no qualifications can have received a fair amount of schooling beyond the primary level. In 2008, for instance, there are almost 8 million people aged 25 or more who are listed as having obtained no diploma. The census tells us, however, that 20% of them have progressed beyond *collège* level (i.e. have at least entered the second cycle of secondary education). This percentage rises to 83% for those aged 25 to 29 years. Unfortunately, the 2008 census provides rather imprecise information on the level of schooling of the population that has obtained no diplomas, distinguishing only between those with either primary or lower secondary attainment on one side and those who have gone beyond lower secondary school on the other. For other census years, not even this information is available.

- Corrections to attainment levels based on diploma counts:

In addition to the usual classification based on the highest diploma obtained by each person, the 1999 Census provides an alternative breakdown of the population by the highest level of schooling they have attained (entered but not necessarily completed) with a fair amount of detail by age group. The relevant information is summarized in Figure A.1 for the entire 25+ population.

**Figure A1: Educational attainment of the population 25+ by two alternative criteria  
Census of 1999.**



Attainment shares according to the two criteria differ for two reasons. At the upper end of the educational distribution, one criterion counts all those who started a given level while the other one counts only those who completed it successfully and obtained the corresponding degree. It is not obvious which of these criteria is preferable and indeed, data availability has forced us to choose different criteria in different countries and even in different educational levels within a given country. At the lower end of the distribution, however, we have seen that the terminal diploma for primary school has been suppressed around 20 years ago and that the one for lower secondary education is optional and not required for entry into upper secondary schooling. Hence, in many cases the absence of these diplomas cannot be identified with the failure to complete the corresponding educational cycle. However, relying on data on diplomas forces us to attribute only a primary education to all

those who have not obtained any academic qualifications and this significantly overstates the fraction of the population who have not progressed beyond elementary school and understates the weight of the population with secondary attainment. As a result, in this particular case, the classification based on the highest educational cycle attained seems preferable.

- While the breakdown by schooling levels of the 1999 census is coarser than we would like (it groups *collège* together with vocational courses leading to BEP and CAP and does not distinguish between short and long university courses), we will use it to correct the available census information (based on diploma counts) in order to approximate the percentage of the population that has started but not necessarily completed each educational level.

The 1999 census provides data on attainment according to the two criteria described above and broken down by 5-year age groups between 25 and 59 years of age and for a single large group that comprises all those aged 60 and over. We have used these data to construct adjustment coefficients that transform “diploma shares” into “attainment shares” in other census years. These coefficients are first constructed for each 1999 cohort as the ratio between the attainment share and the diploma share corresponding to each given educational cycle. The results of this calculation are shown in Table A.10.

**Table A.10: Correction factors for 1999 cohorts,  
ratio of the attainment share to the diploma share for the same educational level**

<i>age in 1999</i>	<i>primary school</i>	<i>Collège+vocational studies (BEP/CAP)</i>	<i>General and technical lycée</i>	<i>Higher education</i>
25 a 29	0.189	1.176	0.975	1.200
30 a 34	0.213	1.177	1.147	1.154
35 a 39	0.253	1.161	1.329	1.140
40 a 44	0.382	1.166	1.414	1.122
45 a 49	0.704	1.053	1.431	1.102
50 a 54	0.825	0.988	1.476	1.073
55 a 59	0.873	1.005	1.372	1.085
60+	0.913	1.106	1.408	1.127
25+	<b>0.751</b>	<b>1.112</b>	<b>1.300</b>	<b>1.136</b>

Correction factors for the entire 25+ population in different census years are then constructed as weighted averages of the correction factors of the different 1999 cohorts, weighting each 1999 cohort by its observed weight in the adult population of each census year. Hence, we are assuming that correction factors can be measured in 1999 and remain constant for each cohort as we move either forward or backward in time, which is not necessarily true (if survival and migration rates are correlated with completion rates) but should be a reasonable approximation. For instance, those aged 35 to 39 in 1999 correspond approximately with those aged 25-29 in 1990, whose weight in the 1990 population is known. Similarly, those aged 60+ in 1999 are identified with those aged 50 and over in 1990 – which is rather more problematic since death rates will vary considerably across subgroups of such a large age group. In the case of 2008, we have assumed that the two youngest adult cohorts

(those aged 25-9 and 30-4 in 2008, which were not part of the 25+ population in 1999) have the same correction factors as the youngest 25+ cohort in 1999.

**Table A.11: Estimated correction factors for the 25+ population in different census years**

<i>Census year</i>	<i>Primary school</i>	<i>Collège+vocational studies (BEP/CAP)</i>	<i>General and technical lycée</i>	<i>Higher education</i>
1960	0.913	1.106	1.408	1.127
1968	0.909	1.096	1.404	1.123
1975	0.898	1.081	1.413	1.116
1982	0.808	1.086	1.415	1.114
1990	0.736	1.092	1.407	1.116
1999	0.751	1.112	1.300	1.136
2008	0.489	1.124	1.256	1.142

Table A.11 shows the estimated correction factors for the different census years. Since lower secondary and vocational upper secondary education are grouped together in the 1999 attainment data, a single correction factor must be computed for both categories. These factors are then applied to the available data on diploma shares (Table A.12) to obtain preliminary estimates of attainment shares in census years. These preliminary results are then rescaled proportionately so they add up exactly to 100% in each given year. The final results of the calculation are given in Table A.13.

**Table A.12: Harmonized diploma shares in census years  
% of the 25+ population not enrolled in school**

	1960	1968	1975	1982	1990	1999	2008
<i>Primary: no diploma + CEP</i>	83.18	78.76	70.37	64.13	51.87	38.56	30.78
<i>Lower secondary: Brevet-BEPC</i>	4.40	4.56	5.48	5.86	7.61	7.98	6.26
<i>Vocational upper sec: CAP-BEP</i>	5.53	8.09	11.37	13.68	18.79	24.47	23.57
<i>General upper sec: BAC</i>	4.04	5.10	6.64	8.14	10.39	11.39	15.00
<i>Higher education diploma</i>	2.85	3.49	6.14	8.18	11.34	17.60	24.38
<i>total</i>	100.00	100.00	100.00	100.00	100.00	100.00	100.00

- Note: data from the harmonized census series, except for 1960, which is a backward projection from 1968.

- The figures shown for 1960 in Table A.13 are backward projections constructed using the detailed breakdown of educational attainment levels by age in 1968 provided in the detailed files (*fichiers detail*) with the harmonized census data and the observed age structure of the population according to the 1960 census (in paper). As usual, we introduce a correction for differential mortality rates for those aged 65 and over (which in this particular case is applied to those aged 67 and over due to the available age breakdown). Since we are projecting back the 1968 census for 8 years, we multiply Barro and Lee's estimates of 5-year differential relative mortality rates by 8/5.

**Table A.13: Estimated attainment shares in census years  
% of the 25+ population not enrolled in school**

	1960	1968	1975	1982	1990	1999	2008
<i>Primary</i>	79.25	74.16	64.71	55.30	40.49	29.01	15.78
<i>Lower secondary</i>	5.08	5.17	6.06	6.80	8.82	8.89	7.39
<i>Vocational upper secondary</i>	6.38	9.18	12.59	15.87	21.77	27.25	27.82
<i>General upper secondary</i>	5.93	7.42	9.62	12.31	15.50	14.83	19.78
<i>Higher education</i>	3.35	4.06	7.02	9.73	13.42	20.02	29.23
<i>total</i>	100.00	100.00	100.00	100.00	100.00	100.00	100.00

- *Breakdown of L3:* The harmonized census data we are using only gives a total for *L3*, without distinguishing between short and long courses in universities and other institutions of tertiary education. To fill in this gap in 1999 and 2008 we use the ratio *L3.2/L3* calculated using the diploma counts given in both censuses and in the Labor Force Survey for 2010. We then estimate the same ratio for earlier censuses using the age detail provided by the 1999 census and the same procedure used above to estimate the correction factors, i.e. by weighting cohort-specific values by their respective weights in the adult population in successive censuses. The census data we use appear to include in *L3.1* short higher education courses (*Bac+2*) and classify as *L3.2* bachelors and higher courses. We use 4 years as the average duration of *L3.2* courses, which include both 3-year bachelors and longer university and *Grands Ecoles* programs.

**Table A.14: Summary of data sources and fill-in procedure for France**

	1960	1965	1968	1970	1975	1980	1982	1985
<i>L1</i>	<b>BP</b>	int	<b>C</b>	int	<b>C</b>	int	<b>C</b>	int
<i>L2.1</i>	<b>BP</b>	int	<b>C</b>	int	<b>C</b>	int	<b>C</b>	int
<i>L2.2</i>	<b>BP</b>	int	<b>C</b>	int	<b>C</b>	int	<b>C</b>	int
<i>L3</i>	<b>BP</b>	int	<b>C</b>	int	<b>C</b>	int	<b>C</b>	int
<i>L3.1</i>	est	int	est	int	est	int	est	int
<i>L3.2</i>	est	int	est	int	est	int	est	int

	1990	1995	1999	2000	2005	2008	2010
<i>L1</i>	<b>C</b>	int	<b>C</b>	int	int	<b>C</b>	<b>Pr S</b>
<i>L2.1</i>	<b>C</b>	int	<b>C</b>	int	int	<b>C</b>	<b>Pr S</b>
<i>L2.2</i>	<b>C</b>	int	<b>C</b>	int	int	<b>C</b>	<b>Pr S</b>
<i>L3</i>	<b>C</b>	int					
<i>L3.1</i>	est	int	<b>C</b>	int	int	<b>C</b>	<b>Pr S</b>
<i>L3.2</i>	est	int	<b>C</b>	int	int	<b>C</b>	<b>Pr S</b>

- *Note:* See the discussion surrounding Table A.1 in the Australia section.

- *Estimates for non-census years:* We interpolate between available census observations (including the backward projection for 1960) to obtain estimates for all years ended in 0 and 5. To estimate 2010 we use LFS data proceeding as follows. Since there are noticeable differences between the 2008 LFS and the last census, instead of using LFS data on diploma counts directly, we project forward to 2010 the diploma shares of the 2008 census using the observed growth rate of such shares between 2008 and

2010 according to the LFS. Diploma shares are then adjusted to estimate attainment shares using the correction factor for 2008. Total tertiary attainment is split between *L3.1* and *L3.2* using the *L3.2/L3* ratio for 2010 calculated with LFS diploma counts.

## 8. Germany

We construct two different series: one for the West Germany for 1960-90 and another one for unified Germany for 1991-2010.

### *Structure of the system*

There are significant differences across states. Education is mandatory from 6 to 17 or 18 years of age. Primary school (*Grundschule*) lasts for 4 years in most states. There are several types of secondary schools. *Gymnasiums* provide an academically-oriented education that prepares students for admission to university. It lasts for up to nine years, from grade 5 to 12 or 13, divided into two cycles. *Gesamtschulen* (comprehensive schools) also provide long programs, up to grade 12, but offer broader and more flexible curricula than *Gymnasiums* and attempt to keep together children of different interests and abilities. *Realschulen* and *Hauptschulen* provide shorter, lower-secondary programs (up to grades 9 or 10), with the latter oriented towards vocational training for less able or academically inclined students.

After completing lower secondary school, many students enroll in an apprenticeship program for 2-3 years during which they continue to receive classes part time at a *Berufsschule* or part-time vocational school. There are also full-time vocational schools at the secondary (*Fachoberschulen* and *Berufsfachschulen*) and post-secondary (*Fachschulen*) levels and vocational colleges or universities of applied sciences (*Fachhochschulen*) and vocational academies that combine academic programs with on-the-job training. Traditionally, universities offered long programs but shorter bachelor degrees have started to be offered in recent years with the introduction of the Bologna process.

*Old East Germany*: All students attended state polytechnic schools between the ages of 6 and 16. This was followed by an apprenticeship or two years of upper secondary schooling before going to university.

For additional details see:

<https://webgate.ec.europa.eu/fpfis/mwikis/eurydice/index.php/Germany:Overview>

[http://en.wikipedia.org/wiki/Education\\_in\\_Germany](http://en.wikipedia.org/wiki/Education_in_Germany)

<http://countrystudies.us/germany/124.htm>

<http://www.euroeducation.net/prof/germanco.htm>

Ute Hippach-Schneider, Martina Krause and Christian Woll (2007). "Vocational education and training in Germany Short description." Cedefop Panorama series; 138 Luxembourg: Office for Official Publications of the European Communities.

[http://www.cedefop.europa.eu/EN/Files/5173\\_en.pdf](http://www.cedefop.europa.eu/EN/Files/5173_en.pdf)

### *Data sources*

The main web page in English of the German Statistical Service (Destatis) is

<http://www.statistik-portal.de/statistik-portal/en/>

However, this site is still under construction and (at the time this paper was written) contains very little useful data. On the other hand, Destatis has responded to our requests for information, both in connection with this paper and its predecessor (de la Fuente and Doménech, 2002) and has provided two data sets (to which we will refer as Destatis I and Destatis II data) that will be discussed below in detail. Our attainment estimates are based primarily on this information but also make use of some data taken from the UN's Demographic Yearbook.

#### **8.1. West Germany, 1960-90**

Walter Hörner, of the Federal Statistical Office (Destatis), provided partial data for the territory of the former West Germany for our previous paper (de la Fuente and Doménech, 2002). These data, to which we will refer as Destatis I, are taken from the 1961 and 1970 Censuses, the Labor Force Surveys of 1976, 1982, 1985, 1991 and 1995 and Education a Glance (with data for 1989). They are shown in Table A.15. Mr. Hörner does not explicitly state the age group to which his data refer but it is likely to be the population 25+ as he was reacting to our preliminary estimates for this age group. Mr. Hörner tried to approximate our schooling categories directly on the basis of the ISCED classification and does not, for instance, distinguish between the vocational and academic branches of upper secondary education.

**Table A.15: Destatis I data for West Germany,  
Attainment shares (%)**

	<i>L1</i>	<i>L1+L21</i>	<i>L22</i>	<i>L31</i>	<i>L32</i>
1961					2.3
1970	14.2				4.7
1976				5.5	6.3
1982				6.2	7.7
1985	2.1			6.7	8.9
1989		22.0	61.0	7.0	10.0
1991		21.0	59.9	8.0	11.1
1992		20.6	60.2	7.8	11.4
1995		18.6	60.9	7.8	12.7
1996*	2.3				

(\*) Data for Germany as a whole.

For the current version of the paper, the online help services of Destatis have supplied some additional information to which we will refer as Destatis II. The Destatis II data for West Germany are taken from the 1961 and 1970 censuses and from several waves of the Labor Force Survey. In principle, these data refer to the population 15+, except for the 1970 observation, which seems to refer

to the entire population. Since this observation seems rather inconsistent with other available information, we disregard it. As we will see below, it takes some work to extract attainment shares based on each person's highest degree from the Labor Force Survey data. For now we take as given our estimates of attainment shares for the 15+ population not in school, which are shown in Table A.16.

**Table A.16: Destatis II data for West Germany**

	<i>L1</i>	<i>L1+L21</i>	<i>L22</i>	<i>L31</i>	<i>L32</i>
1961				<b>4.1</b>	2.1
1976		43.0	47.3	4.7	5.0
1978		41.7	48.3	4.7	5.3
1980		37.2	51.8	5.0	6.0
1982		37.4	51.7	4.9	6.0
1985		33.7	54.2	5.4	6.7
1987		31.3	56.3	5.3	7.2
1989		27.0	59.3	5.9	7.8

There are also some observations taken from the UN's Demographic Yearbook (DYB) for *L2* (with 1970 = 42.4 and 1980 = 52.6) which seem to fit in quite well with other data if we reinterpret them as applying to *L2.2*.

Comparing the Destatis I and II series, their time profiles seem to be roughly similar but with a level difference that is consistent with the different age groups covered by each of them. Hence, we will work primarily with the Destatis I data, which seems to refer to the 25+ age group, and use Destatis II and other sources to try to complete the series.

Starting from the Destatis I data, we proceed as follows:

- 1) We calculate the ratio  $L3.1/L3.2$  in 1961 according to Destatis II and apply it to *L3.2* in the same year according to Destatis I to estimate the missing value of *L3.1* in 1961. With this, we have a complete series of *L3.1* and *L3.2* for 1961-1991.
- 2) We have observations for *L1* in 1970, 1985 and 1996 (the last one refers to Unified Germany but we assume that it also applies to West Germany). We interpolate linearly between these years and extrapolate back to 1960 to estimate a complete series of *L1*. From *L1* and *L3* we can also infer the value of *L2*.
- 3) For 1970 and 1980 we use the DYB observations for *L2* interpreting them as *L2.2*. As an indirect check on the plausibility of these figures, we observe that the 1980 DYB observation (52.6) is roughly consistent with the value we obtain (53.25) projecting backward to 1980 the 1989 observation from Destatis I (which is the first observation we have for *L2.2* in this source) using the growth rate of *L2.2* according to Destatis II. We interpolate between available observations or estimates to complete the *L2.2* series for 1970 onward. The only missing category is then *L2.1*, which is recovered as a residual.

- 4) Next, we need to estimate the breakdown of *L2* into *L2.1* and *L2.2* in 1960. We compute the ratio  $L2.2/L2$  in 1970 and 1976, extrapolate it back to 1960 and apply it to the estimated *L2* (which we obtain as a residual from our estimates of *L1* and *L3*).
- 5) This gives us complete series for 1961-91 at the irregular frequency supplied by Destatis I. Finally, we complete quinquennial series for 1960 to 1990 by interpolating or extrapolating between the available years.
- 6) For 1975 onward, we break down *L2.2* into its vocational and academic branches using the ratio  $L2.2voc/L2.2$  observed in the Destatis II data.

**Table A.17: Summary of data sources and fill-in procedure for West Germany**

	1960	1961	1965	1970	1975	1976	1980	1982	1985	1989	1990	1991	1996
<i>L1</i>	ext	ext	ext	<b>C</b>	int	int	int	int	<b>S</b>	int	int	int	<b>S</b>
<i>L2.1</i>		est		<b>dif</b>			<b>dif</b>		dif	dif	dif	dif	
<i>L1+L2.1</i>										<b>S</b>	int	<b>S</b>	
<i>L2.2</i>	ext	est	ext	<b>DYB</b>	int		<b>DYB</b>		int	<b>S</b>	int	<b>S</b>	
<i>L3.1</i>	ext	est	int	<b>C</b>	int	<b>S</b>	int	<b>S</b>	<b>S</b>	<b>S</b>	int	<b>S</b>	
<i>L3.2</i>	ext	<b>C</b>	int	<b>C</b>	int	<b>S</b>	int	<b>S</b>	<b>S</b>	<b>S</b>	int	<b>S</b>	

- Note: See the discussion surrounding Table A.1 in the Australia section.

**Note: the Destatis II data**

An important problem with the Destatis II data taken from the Labor Force Survey is that it does not give us a clean breakdown of the population by the highest educational level completed but a double classification in terms, on the one hand, of school education and, on the other, of post-school (vocational or university) training. For instance, a person who has finished *Gymnasium* and gone on to obtain a university degree would be counted twice: as an *Abitur* holder in the school classification and as a university graduate in the post-school classification.

**Table A.18: Destatis II data for West Germany  
breakdown of the population 15+ by their school education  
Total population and % of the population by highest completed educational level**

<i>year</i>	<i>pop. 15+ not in school</i>	<i>Hauptschule and similar</i>	<i>Realschule and similar</i>	<i>Gymnasium and similar</i>
		<i>L1+L2.1</i>	<i>L2.1</i>	<i>L2.2 acad</i>
1976	46,613,000	77.18	14.82	8.00
1978	46,778,000	76.44	15.11	8.45
1980	47,885,000	74.77	15.17	10.06
1982	48,620,000	72.73	16.76	10.51
1985	49,372,000	68.65	18.57	12.79
1987	49,728,000	67.11	19.27	13.62
1989	50,481,000	64.45	20.20	15.35

Tables A.18 and A.19 summarize the original Destatis II data for 1976 onward. Table A.18 shows the total population 15+ of West Germany and its breakdown by the type of school attended. Since only secondary schools are considered and the entire target population is classified into one of three categories, we have to assume that the lowest type considered (*Hauptschule* and similar) includes people with less than a lower secondary school education. Table A.19 gives the breakdown of the same population group by its post-school training. In both tables, we indicate the attainment level (in terms of our classification) we have assigned to each Destatis category, distinguishing between academic and vocational cycles in the case of upper secondary studies (*L2.2voc* y *L2.2acad*).

**Table A.19: Destatis II data for West Germany  
breakdown of the population 15+ by their completed post-school training  
% of the total by attainment level**

<i>year</i>	<i>Apprenticeships L2.2 voc</i>	<i>Fachschule Vocational Schools L3.1</i>	<i>Fachhochschule Technical Universities L3.2</i>	<i>Hochschule Universities L3.2</i>
1976	44.29	4.69	1.65	3.33
1978	45.13	4.68	1.71	3.55
1980	47.71	5.04	2.08	3.94
1982	47.20	4.91	1.96	4.07
1985	48.08	5.43	2.32	4.39
1987	49.80	5.32	2.54	4.63
1989	51.70	5.92	2.69	5.07

**Table A.20: Destatis II data for West Germany  
Estimated breakdown of the population 15+ by the highest level of schooling completed  
% of the total by attainment level**

	<i>L1+2.1 net</i>	<i>L2.2ac net</i>	<i>L2.2voc</i>	<i>L3.1</i>	<i>L3.2</i>
1976	43.02	3.02	44.29	4.69	4.98
1978	41.74	3.18	45.13	4.68	5.27
1980	37.18	4.05	47.71	5.04	6.02
1982	37.39	4.48	47.20	4.91	6.03
1985	33.69	6.08	48.08	5.43	6.71
1987	31.26	6.45	49.80	5.32	7.17
1989	27.03	7.59	51.70	5.92	7.76

Using the information in Tables A.18 and A.19, we have estimated the breakdown of the out-of-school 15+ population by the highest level of schooling completed by each person using our classification. First, we estimate net attainment shares for each school category by subtracting from the gross shares shown in Table A.18 the shares of those post-school training cycles which normally go through each type of secondary school. Hence, *L3.2* is subtracted from *L2.2acad* to obtain the net value of this second category (ie. the fraction of the population that completed *Gymnasium* but did not graduate from University) and *L2.2voc* + *L3.1* is subtracted from *L1+L2.1* since apprentices and advanced vocational

students generally come from less academically oriented secondary schools. Next, we combine the different Destatis categories that correspond to the same attainment level in our classification. The results of these calculations are shown in Table A.20.

## 8.2. Unified Germany, 1991-2010

### *Destatis II data*

Tables A.21 and A.22 show the raw Destatis II data we have for the period after unification. These data are taken from the LFS and refer to the out of school 15+ population. Hence, attainment data for United Germany will not be strictly comparable to those for West Germany, which refer to the 25+ population. The tables incorporate some new schooling categories that correspond to East German schools. One further complication in these data is that it appears that in this period people can choose not to reply to the schooling question. As a result, there is a significant (and rather variable) fraction of the population for which educational attainment is not known in the post-1990 Destatis II data. From 1996 onward, there is also a new category of people without schooling, which we will identify with primary schooling or lower.

**Table A.21: Destatis II data for Unified Germany  
breakdown of the out of school 15+ population by their school education  
Total population and % of the population by highest school level completed**

year	pop. 15+ not in school	Hauptschule and similar L2.1	Realschule and similar L2.1	East		no schooling L1	unknown
				German Polytechnic L2.1	Gymnasium and similar L2.2 acad		
1991	64,425,000	50.75	16.61	7.69	13.97		10.98
1993	65,526,000	49.79	16.62	7.17	15.31		11.11
1995	65,833,000	50.74	18.02	7.03	16.58		7.63
1996	66,026,000	49.67	16.09	8.80	16.88	2.54	6.01
1997	66,206,000	49.24	16.76	8.41	17.49	2.40	5.70
1998	66,288,000	48.45	17.16	8.39	17.94	2.36	5.69
1999	66,404,000	47.70	17.97	7.56	18.55	2.33	5.89
2000	66,662,000	45.47	18.22	7.58	18.70	2.52	7.51
2001	66,869,000	45.87	18.91	7.44	19.45	1.99	6.34
2002	67,092,000	44.88	19.07	7.42	19.92	2.42	6.30
2003	67,398,000	43.61	18.89	7.13	20.91	2.80	6.66
2004	67,702,000	42.76	18.96	6.94	21.30	2.74	7.30
2005	67,583,000	43.73	21.35	6.83	23.53	3.67	0.89
2006	67,827,000	43.16	21.66	6.77	24.04	3.57	0.80
2007	67,961,000	42.40	21.83	6.85	24.67	3.41	0.85
2008	68,543,000	40.82	21.95	6.85	25.40	4.01	0.97
2009	68,531,000	39.90	22.24	6.77	26.22	4.03	0.84
2010	68,535,000	38.32	22.48	7.36	26.74	4.27	0.83

Before we can proceed to estimate net attainment shares based on each person's highest degree, we need to impute the unknowns to the other categories. To do this, we proceed as follows.

First, we group categories that correspond to the same attainment level and fill in the three missing observations for *L1* at the beginning of the period. For 1991 we take the estimate we constructed for West Germany in that year. Then we interpolate between 1991 and the first observation in 1996 to complete the series. We subtract the estimate of *L1* from the share of “unknowns” in these early years.

Second, we compute the annualized changes in the shares of the different schooling categories in the out of school 15+ population. Since the interval between some of the observations at the beginning of the sample period is different from one year, we divide the observed change in the variables of interest between two consecutive observations by the time elapsed between them. Then, we regress the annualized change in the shares of the different educational categories on a constant and the annualized change in the share of unknowns. Notice that there are two “unknown” series, one for school attainment and the other for post-school training and, correspondingly, two groups of regressions, one for the variables in Table A.21 and the other for the variables in Table A.22 (after grouping them if necessary). The results are shown in Table A.23. Notice that the slope coefficients of each set of regressions add up almost exactly to 1

**Table A.22: Destatis II data for Unified Germany  
% of the total by highest post-school level completed**

	<i>Apprenticeships</i> <i>L2.2 voc</i>	<i>vocational</i> <i>schools</i> <i>L3.1</i>	<i>universities</i> <i>and technical</i> <i>universities</i> <i>L3.2</i>	<i>no post-school</i> <i>qualifications</i>	<i>unknown</i>
1991	49.07	7.85	7.80	20.91	14.37
1993	49.38	7.08	8.52	21.08	13.95
1995	51.81	7.65	9.51	22.14	8.89
1996	50.05	7.13	10.00	24.72	8.09
1997	51.46	7.63	10.44	23.21	7.26
1998	51.74	7.58	10.73	23.12	6.82
1999	49.94	7.99	9.92	23.76	8.38
2000	48.36	8.02	9.98	23.22	10.41
2001	50.12	7.87	10.15	22.66	9.21
2002	50.23	7.31	10.92	22.79	8.75
2003	49.91	7.41	11.10	22.90	8.69
2004	48.63	7.46	11.45	22.94	9.53
2005	52.24	7.92	12.16	26.89	0.79
2006	52.64	7.19	12.38	27.19	0.60
2007	53.22	7.09	12.86	26.03	0.80
2008	52.77	7.28	13.52	25.41	1.03
2009	52.34	7.62	14.10	25.01	0.93
2010	52.03	7.91	14.08	25.12	0.86

We use the estimated slope coefficients (after rescaling them so they add up exactly to 1 for each group of regressions) to allocate the people with unknown (school and post-school) attainment to the remaining attainment categories. The results (i.e., the estimated gross attainment shares) are shown in Table A.24. Finally, we recover net attainment shares by subtracting post-school attainment shares

from the school attainment shares from which they are most likely to come. The final series are shown in Table A.25.

**Table A.23: results of auxiliary regressions used to allocate the “unknown” schooling group among schooling categories**

<i>dep var =</i>	<i>dL2.1</i>	<i>dL2.2acad</i>	<i>dnoschool</i>	<i>L2.2voc</i>	<i>dL3.1</i>	<i>dL3.2</i>	<i>dnopostschool</i>
<i>regressor =</i>	<i>dunknown1</i>	<i>dunknown1</i>	<i>dunknown1</i>	<i>dunknown2</i>	<i>dunknown2</i>	<i>dunknown2</i>	<i>dunknown2</i>
constant	-0.670 (6.33)	0.590 (12.26)	0.081 (1.06)	-0.220 (1.07)	-0.014 (0.15)	0.274 (3.21)	-0.040 (0.17)
slope	-0.676 (10.92)	-0.236 (8.41)	-0.088 (1.99)	-0.495 (5.66)	-0.038 (0.93)	-0.072 (1.98)	-0.395 (3.87)
R2	0.8882	0.825	0.2087	0.6812	0.0545	0.2077	0.4996

- Note: *t* values in parentheses below each estimated coefficient

**Table A.24: Estimated gross attainment shares after imputing the unknown attainment categories**

	<i>L1</i>	<i>L2.1</i>	<i>L2.2acad</i>	<i>L2.2voc</i>	<i>L3.1</i>	<i>L3.2</i>
1991	3.00	80.96	16.04	56.18	8.39	8.83
1993	3.13	79.49	17.38	56.28	7.60	9.53
1995	2.94	79.27	17.79	56.21	7.99	10.15
1996	3.07	78.63	18.30	54.06	7.44	10.59
1997	2.91	78.26	18.83	55.05	7.90	10.97
1998	2.87	77.84	19.29	55.11	7.84	11.23
1999	2.85	77.20	19.94	54.09	8.31	10.53
2000	3.19	76.34	20.48	53.51	8.42	10.73
2001	2.55	76.49	20.95	54.67	8.22	10.81
2002	2.97	75.62	21.40	54.56	7.64	11.55
2003	3.39	74.13	22.48	54.21	7.74	11.72
2004	3.38	73.59	23.02	53.34	7.82	12.13
2005	3.74	72.51	23.74	52.63	7.95	12.21
2006	3.64	72.13	24.23	52.94	7.21	12.42
2007	3.49	71.65	24.87	53.61	7.12	12.92
2008	4.09	70.28	25.63	53.28	7.32	13.59
2009	4.10	69.48	26.42	52.80	7.65	14.17
2010	4.34	68.72	26.94	52.46	7.95	14.14

**Table A.25: Estimated net attainment shares**

	<i>L1</i>	<i>L2.1</i>	<i>L2.2acad</i>	<i>L2.2voc</i>	<i>L3.1</i>	<i>L3.2</i>
1991	3.00	16.39	7.21	56.18	8.39	8.83
1993	3.13	15.61	7.85	56.28	7.60	9.53
1995	2.94	15.08	7.64	56.21	7.99	10.15
1996	3.07	17.13	7.71	54.06	7.44	10.59
1997	2.91	15.31	7.87	55.05	7.90	10.97
1998	2.87	14.89	8.06	55.11	7.84	11.23
1999	2.85	14.81	9.41	54.09	8.31	10.53
2000	3.19	14.41	9.74	53.51	8.42	10.73
2001	2.55	13.60	10.14	54.67	8.22	10.81
2002	2.97	13.42	9.85	54.56	7.64	11.55
2003	3.39	12.18	10.76	54.21	7.74	11.72
2004	3.38	12.44	10.89	53.34	7.82	12.13
2005	3.74	11.93	11.53	52.63	7.95	12.21
2006	3.64	11.98	11.81	52.94	7.21	12.42
2007	3.49	10.92	11.95	53.61	7.12	12.92
2008	4.09	9.68	12.04	53.28	7.32	13.59
2009	4.10	9.03	12.25	52.80	7.65	14.17
2010	4.34	8.31	12.80	52.46	7.95	14.14

Note: for the final quinquennial series, the observation labeled 1990 corresponds really to 1991.

**Table A.26: Summary of data sources and fill-in procedure for Unified Germany**

	1991	1995	1996	2000	2005	2010
<i>L1</i>	est	int	S	S	S	S
<i>L2.1</i>	est	int	S	S	S	S
<i>L2.2</i>	S	S		S	S	S
<i>L3.1</i>	S	S		S	S	S
<i>L3.2</i>	S	S		S	S	S

- Note: See the discussion surrounding Table A.1 in the Australia section.

## 9. Greece

### *Structure of the system and attainment categories*

Primary school lasts for six years between the ages of 6 and 12. It is followed by a compulsory three-year lower secondary education course in a *Gymnasio*. After this, students can enroll in an academic upper secondary school known as *Lykeo* for another three years or enter vocational training, which lasts between one and four years. Higher education is provided by universities, polytechnics and TEIs (Technological Educational Institutes). Until the 1980s there were also “intermediate schools.” These included teacher colleges and higher vocational, technical and ecclesiastical educational institutions that offered relatively short courses (of 2-3 years). In the 2001 census graduates of “Intermediate schools” are grouped together with those of TEIs (Technological Educational Institutes). While the distinction between TEIs and universities seems to be less sharp than that between universities and

intermediate schools, we follow the Greek census in including intermediate schools and TEIs in the same group of non-university higher education which we identify with L3.1.

For further details see for instance

<https://webgate.ec.europa.eu/fpfis/mwikis/eurydice/index.php/Greece:Overview>

[http://en.wikipedia.org/wiki/Education\\_in\\_Greece](http://en.wikipedia.org/wiki/Education_in_Greece)

<http://www.ekep.gr/english/education/main.asp>

[http://archive.minedu.gov.gr/en\\_ec\\_page1531.htm](http://archive.minedu.gov.gr/en_ec_page1531.htm)

and the Statistical Yearbooks referenced below.

- *Attainment categories*; L3.2 = higher education (university) degree or higher (masters and doctorate); L3.1 = intermediate school certificate + attending a higher or intermediate school, or TEI or post-secondary diplomas or third-level vocational-technical degree; L2.2 = completed secondary education or TVL or TVS certificates. L2.1 = have finished at least the third course of secondary education; L1 = complete or incomplete primary or no schooling but literate; L0 = illiterate (or no schooling in 2010).

### ***Data Sources***

We use data for the 25+ population from the national censuses of 1981, 1991 and 2001 and Labor Force Survey for 2010. The data are taken from the website of the Hellenic Statistical Authority:

Hellenic statistical authority webpage. Statistical themes. Population. Usual residence population. Age Groups and Educational Attainment. Greece Total by Urban and Rural  
[http://www.statistics.gr/portal/page/portal/ESYE/PAGE-themes?p\\_param=A1602&r\\_param=SAM03&y\\_param=2001\\_00&mytabs=0](http://www.statistics.gr/portal/page/portal/ESYE/PAGE-themes?p_param=A1602&r_param=SAM03&y_param=2001_00&mytabs=0)

Labor Force Survey, 2010, Table 1: Population (age groups, education level, sex) (2nd Quarter )  
[http://www.statistics.gr/portal/page/portal/ESYE/PAGE-themes?p\\_param=A0101&r\\_param=SJO01&y\\_param=2010\\_02&mytabs=0](http://www.statistics.gr/portal/page/portal/ESYE/PAGE-themes?p_param=A0101&r_param=SJO01&y_param=2010_02&mytabs=0)

The Statistical Yearbook of Greece contains census data on education and on the age distribution of the population. Issues dating back to the 1930's are available in pdf format at:

Hellenic Statistical Authority, Digital Library, General Publications, Statistical Yearbook of Greece  
[http://dlib.statistics.gr/portal/page/portal/ESYE/categoryyears?p\\_cat=10007369&p\\_topic=10007369](http://dlib.statistics.gr/portal/page/portal/ESYE/categoryyears?p_cat=10007369&p_topic=10007369)

### ***Estimation and fill-in procedure***

- *Backward projection*: The 1981 census has a finer breakdown by age and educational level than the previous ones (1961 and 1971, which are also available). We project attainment backward using the observed age structures in 1961 and 1971 (with census data for these years taken from the 1963 and 1974 Yearbooks), correcting for differential mortality by attainment level in the usual way. The results are roughly consistent with the original census data for those years but more detailed.

- We interpolate and extrapolate linearly to estimate missing observations.

- L2.2 cannot be broken down into its academic and vocational tracks.

**Table A.27: Summary of data sources and fill-in procedure for Greece**

	1960	1961	1965	1970	1971	1975	1980	1981
<i>L1</i>	ext	<b>BP</b>	int	int	<b>BP</b>	int	int	<b>C</b>
<i>L2.1</i>	ext	<b>BP</b>	int	int	<b>BP</b>	int	int	<b>C</b>
<i>L2.2</i>	ext	<b>BP</b>	int	int	<b>BP</b>	int	int	<b>C</b>
<i>L3.1</i>	ext	<b>BP</b>	int	int	<b>BP</b>	int	int	<b>C</b>
<i>L3.2</i>	ext	<b>BP</b>	int	int	<b>BP</b>	int	int	<b>C</b>
	1985	1990	1991	1995	2000	2001	2005	2010
<i>L1</i>	int	int	<b>C</b>	int	int	<b>C</b>	int	<b>S</b>
<i>L2.1</i>	int	int	<b>C</b>	int	int	<b>C</b>	int	<b>S</b>
<i>L2.2</i>	int	int	<b>C</b>	int	int	<b>C</b>	int	<b>S</b>
<i>L3.1</i>	int	int	<b>C</b>	int	int	<b>C</b>	int	<b>S</b>
<i>L3.2</i>	int	int	<b>C</b>	int	int	<b>C</b>	int	<b>S</b>

- Note: See the discussion surrounding Table A.1 in the Australia section.

## 10. Ireland

### *Structure of the system*

Primary school lasts for six years (preceded by two years of non-compulsory kindergarten). It is followed by a 3-year mandatory cycle of lower secondary schooling and a 2 or 3-year optional upper secondary course. Students can choose between academic and vocational tracks which are generally (but not always) offered in separate, specialized schools. At the end of this cycle they take the Leaving Certificate Examination, choosing among three different exams (and preparatory programs): a general one meant for students who want to go to university and two vocationally oriented programs, one of which lasts only two years. After secondary school, students have access to short (one or two-year) post-secondary vocational programs (post-leaving certificate courses, PLC, established in the mid eighties, which substitute a large number of unregulated courses and qualifications) and to universities, colleges and institutes of technology that provide both short (certificates) and long programs. For further details see for instance:

<https://webgate.ec.europa.eu/fpfis/mwikis/eurydice/index.php/Ireland:Overview>

<http://www.educationireland.ie/index.php/irish-education>

[http://en.wikipedia.org/wiki/Education\\_in\\_the\\_Republic\\_of\\_Ireland](http://en.wikipedia.org/wiki/Education_in_the_Republic_of_Ireland)

### *Data sources*

We use national census data for the population 25+ (no longer attending school full time for 1991 onward) from the censuses of 1966, 1971, 1981, 1991, 2002 and 2006, taken from the census section of the website of Ireland's Central Statistical Office, <http://www.cso.ie/en/census/>

Preliminary results from the 2011 census are available at:

<http://www.cso.ie/en/census/census2011reports/census2011thisisirelandpart2/>

*Other links of interest:* There is a module on educational attainment on the Quarterly National Household Survey which we have not used because it refers to the 15-64 population and is hard to reconcile with the census. The main difference between the two sources is that the survey includes PLC courses as a separate category whereas the census does not. Comparing the two sources with data for 2006, there are significant differences between them and it is not clear how the census classifies PLC courses.

A recent report on the subject with some useful data for recent years can be found at:

Quarterly National Household Survey. Educational Attainment Thematic Report 2011.

<http://www.cso.ie/en/media/csoie/releasespublications/documents/education/2011/educationalattainment2011.pdf>

The main link to the household survey is

<http://www.cso.ie/en/qnhs/>

#### *Estimation and fill in procedure*

- Figures for 1961 are estimated by a backward projection of the 1966 census data on attainment by age group using the age structure of the population in 1961. We correct in the usual way for differential mortality for the population 65+.
- Census information does not allow a breakdown of *L3* into first and second cycles before 2002<sup>10</sup> or of *L2* into *L2.1* and *L2.2* before 1991. We estimate this breakdown using data disaggregated by age group from the 1991 and 2002 censuses. For *L3* we observe that the ratio *L3.2/L3* stabilizes in the 2002 census for the older age groups around 0.69, which we take as the 1961 value for this ratio. We then interpolate between this estimate for 1961 and the observed value of this ratio in 2002 and apply the result to our *L3* series to recover *L3.1* and then *L3.2*. To recover *L2.1* and *L2.2* we proceed in a similar way, using data from the 1991 census. Since this ratio does not seem to change significantly across age groups, we keep constant the value of 0.587 observed in 1991 for earlier years. There is insufficient information to disaggregate *L2.2* into a vocational and a general component.
- After completing in this way the series for the available census years, we construct quinquennial series for the period 1960-2010 by linear interpolation and extrapolation.
- For 1991, 2002 and 2006 the data refer in principle to the highest level completed (except for primary, which includes those with incomplete studies). For 1966, 1971 and 1981 the data refer in principle to the highest level attained. This change in classification criterion, however, does not seem to produce a significant discontinuity in the series, suggesting perhaps that the number of students who drop out without completing a given level is relatively small. In 1981, primary includes those whose education

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<sup>10</sup> Starting in 2002 it distinguishes between “non-degree”, which we identify with *L3.1* and “degree or higher” which we identify with *L3.2*.

level is unknown. In more recent years, these are shown separately as “not stated” and have been ignored when computing attainment shares as their number is rather small (4.5% of the total in 2006).

- 2010 is a linear extrapolation using 2001 and 2006 data.

- Preliminary data from the 2011 are available only for the 15+ population. Waiting for the publication of the detailed results (expected for November in the case of education), we have not used the preliminary data because a comparison with the 2006 results suggests that there has been a change in classification criteria. In particular, *L3.1* drops by 60% between 2006 and 2011 while both *L2.2* and *L3.2* display a large increase.

**Table A.28: Summary of data sources and fill-in procedure for Ireland**

	1960	1961	1965	1966	1970	1971	1975	1980	1981
<i>L1</i>	ext	<b>BP</b>	int	<b>C</b>	int	<b>C</b>	int	int	<b>C</b>
<i>L2</i>	ext	<b>BP</b>	int	<b>C</b>	int	<b>C</b>	int	int	<b>C</b>
<i>L2.1</i>	ext	est	int	est	int	est	int	int	est
<i>L2.2</i>	ext	est	int	est	int	est	int	int	est
<i>L3</i>	ext	<b>BP</b>	int	<b>C</b>	int	<b>C</b>	int	int	<b>C</b>
<i>L3.1</i>	ext	est	int	est	int	est	int	int	est
<i>L3.2</i>	ext	est	int	est	int	est	int	int	est
	1985	1990	1991	1995	2000	2002	2005	2006	2010
<i>L1</i>	int	int	<b>C</b>	int	int	<b>C</b>	int	<b>C</b>	ext
<i>L2</i>									
<i>L2.1</i>	int	int	<b>C</b>	int	int	<b>C</b>	int	<b>C</b>	ext
<i>L2.2</i>	int	int	<b>C</b>	int	int	<b>C</b>	int	<b>C</b>	ext
<i>L3</i>	int	int	<b>C</b>						
<i>L3.1</i>	int	int	est	int	int	<b>C</b>	int	<b>C</b>	ext
<i>L3.2</i>	int	int	est	int	int	<b>C</b>	int	<b>C</b>	ext

- Note: See the discussion surrounding Table A.1 in the Australia section.

## 11. Italy

### *Structure of the system*

Education is compulsory between the ages of 6 and 16. Primary school lasts for 5 years and is followed by 3 years of lower secondary school. Upper secondary school generally lasts for 5 years and concludes with an exam (*Esame di maturità*) required to receive a diploma and have access to higher education. There are several types of upper secondary schools. The *Liceo* provides a general, academically oriented education whereas the *Istituti Tecnici* and *Istituti Professionali* provide technical and vocational courses (which in the last case be as short as three years). There are also vocational schools organized by the regions (*Istruzione e Formazione Professionale*) that provide 3 or 4 year courses.

Until recently, universities offered only long programs (generally of 5 years) leading directly to the equivalent of a Masters' degree (*Laurea*). With the Bologna process, long degrees have been split into a

starting 3-year bachelors degree (*Laurea Triennale*) followed by an additional 2-year master's (*Laurea Magistrale*). There is also a non-university post-secondary education sector that provides short vocational and technical courses. This includes the IFTS system (*Instruzione e formazione tecnica superiore*) managed by the central government, which provides courses of up to 2 years that often include an apprenticeship-like component providing hands-on experience in private firms, and short post-secondary qualifications offered by the regional systems of *Formazione Professionale*.

For further details see for instance

<https://webgate.ec.europa.eu/fpfis/mwikis/eurydice/index.php/Italy:Overview>

[http://en.wikipedia.org/wiki/Education\\_in\\_Italy](http://en.wikipedia.org/wiki/Education_in_Italy)

<http://www.euroeducation.net/prof/italco.htm>

<https://webgate.ec.europa.eu/fpfis/mwikis/eurydice/index.php/Italy:Overview>

### *Data sources*

Our data are taken from the ISTAT website. The population censuses of 1961, 1971, 1981, 1991 and 2001 provide data for the population 6+ while the Labor Force Survey for 2001, 2005 and 2010 refers to the population 25+.

ISTAT website. Time series: Italian Statistical Historical Repository. Education. Education in census of population. Table 7.1 Resident population aged 6 and over by educational attainment and geographic division at census year - 1951-2001 population censuses.

[http://timeseries.istat.it/index.php?id=60&user\\_100ind\\_pi1\[id\\_pagina\]=171&cHash=8c8b7801a09ee5818c074a6db744347b](http://timeseries.istat.it/index.php?id=60&user_100ind_pi1[id_pagina]=171&cHash=8c8b7801a09ee5818c074a6db744347b)

ISTAT website. Time series: Italian Statistical Historical Repository. Education. Schooling. Table 7.3. Enrolment in pre-primary, primary, secondary and tertiary school by school or academic year - Years 1861/62-2008/09.

[http://timeseries.istat.it/index.php?id=60&user\\_100ind\\_pi1\[id\\_pagina\]=170&cHash=2b905cb81cb25ccbb73bf93fd190174e](http://timeseries.istat.it/index.php?id=60&user_100ind_pi1[id_pagina]=170&cHash=2b905cb81cb25ccbb73bf93fd190174e)

ISTAT website. Time series: Italian Statistical Historical Repository. Population. Structural indicators and evolution of population at censuses. Table 2.2.1. Population for class of ages and sex, aging ratio and dependency ratio at Census from 1861 to 2001.

[http://timeseries.istat.it/index.php?id=60&user\\_100ind\\_pi1\[id\\_pagina\]=189&cHash=a32f635eedace55869a47149c712d21f](http://timeseries.istat.it/index.php?id=60&user_100ind_pi1[id_pagina]=189&cHash=a32f635eedace55869a47149c712d21f)

Annuario Statistico Italiano 2002 (with LFS data for 2001).

[http://www3.istat.it/dati/catalogo/20021106\\_00/](http://www3.istat.it/dati/catalogo/20021106_00/)

I.Stat online database. Education and training. Population 15 years and over by highest level of education (LFS data for years 2004 to 2010).

<http://dati.istat.it/Index.aspx>

### *Estimation and fill-in procedure*

- For 1961-91, the only available data refer to the population 6+. We correct these data by “subtracting” from it an estimate of the population 6-24 broken down by their level of educational attainment. This estimate is constructed as follows using data from the Italian Statistical Historical Repository on the age distribution of the population and on enrollments at primary, secondary and

university levels in each of the different census years. Using the age data, we approximate the number of people who would be of the right age to be enrolled in each educational level and, dividing the number of students of each level by this figure, we obtain estimates of the primary, secondary and university enrollment rates (without distinguishing between lower and upper secondary school, as no breakdown between them is provided). Since the estimated enrollment rate at the primary level is slightly over 100%, we leave it at 100%. Next, we estimate the number of people 6-24 who are old enough to have completed each of the different educational levels (distinguishing between the first and second cycles of secondary) and approximate the number of them who have actually completed each level by multiplying their total number by the corresponding estimate of the enrollment rate (using a common value for both cycles of secondary). From this, we recover an estimate of the population 6-24 broken down by the highest level completed (or still enrolled in primary school). These figures are then subtracted from the corresponding totals for the 6+ population and attainment counts for each category are divided by the total population 25+ to estimate attainment shares.

It should be noted that this procedure leaves the number of illiterates (*L0*) given for the 6+ population unchanged. It seems reasonable, however, to assume that the bulk of illiterates belong to the older segments of the population.

- We use adjusted census data for 1961-2001 and LFS data for 2005 and 2010. We interpolate between available observations and extrapolate back to 1960 to complete the quinquennial series.
- For 2001 we have both census and LFS data. There are differences between them but they are relatively small.
- For 2005 and 2010 we have no data on illiterates. By 2001, however, the weight of this category has fallen to only 1.84%. We assume it falls by 1/6<sup>th</sup> each five years, which is approximately consistent with the time profile for earlier years.
- Until recent years, there seemed to be only long university courses with a typical duration of 5 years. Starting in 2001-02, Italy starts moving to a different system with a first degree after 3 years followed by a 2-year second degree. We could not find any data on the breakdown of university graduates but, for the time being, those with short degrees must be only a small minority, so we use 5 years as the standard university duration for the calculation of average years of schooling.
- It is not possible to disaggregate *L2.2* into *L2.2voc* y *L2.2ac*.
- *Note:* The data do not seem to take into account post-secondary vocational qualifications (and possibly, regional secondary vocational qualifications). Since there is no specific category for this level in the census, holders of IFTS and regional credentials who do not have a university degree must be included in *L2.2*. The English version of the LFS data is rather misleading in this respect, as it includes "upper secondary" and "postsecondary" as separate levels. Comparison with the Italian version of the same data, however, reveals that "upper secondary" refers to shorter vocational upper secondary diplomas (*qualifica professionale*) and "post-secondary" to the *maturità*.

**Table A.29: Summary of data sources and fill-in procedure for Italy**

	1960	1961	1965	1970	1971	1975	1980	1981
<i>L1</i>	ext	C	int	int	C	int	int	C
<i>L2.1</i>	ext	C	int	int	C	int	int	C
<i>L2.2</i>	ext	C	int	int	C	int	int	C
<i>L3.1</i>								
<i>L3.2</i>	ext	C	int	int	C	int	int	C
	1985	1990	1991	1995	2000	2001	2005	2010
<i>L1</i>	int	int	C	int	int	C	S	S
<i>L2.1</i>	int	int	C	int	int	C	S	S
<i>L2.2</i>	int	int	C	int	int	C	S	S
<i>L3.1</i>								
<i>L3.2</i>	int	int	C	int	int	C	S	S

- Note: See the discussion surrounding Table A.1 in the Australia section.

## 12. Japan

### *Structure of the system*

Primary school lasts for six years, followed by three years of lower secondary school and another three of upper secondary school. Primary and lower secondary school are mandatory. Upper secondary schools offer both academic and vocational programs. There are also a variety of vocational training institutions that offer both upper secondary and post-secondary courses. Higher education is provided by junior colleges, which offer short programs of 2 or 3 years and by universities, which offer longer programs (generally of four years) leading to the bachelor's degree, followed by postgraduate courses at the master and doctoral levels. For further details see for instance

<http://www.stat.go.jp/english/data/handbook/c16cont.htm>

[http://en.wikipedia.org/wiki/Education\\_in\\_Japan](http://en.wikipedia.org/wiki/Education_in_Japan)

<http://www.ibe.unesco.org/International/ICE47/English/Natreps/reports/japan.pdf>

<http://www.ibe.unesco.org/en/services/online-materials/world-data-on-education/seventh-edition-2010-11.html>

### *Data Sources:*

For 1960, 1970, 1980 and 1990, we use census data on *L1+L2.1*, *L2.2*, *L3.1* and *L3.2* supplied by Takao Ito of Japan's Statistical Office for our previous paper. To extend the series to 2000 and 2010 we use data from the 2000 and 2010 censuses taken from the website of e-Stat with the help of their online help service for an English translation of the most recent data. For a breakdown between *L1* and *L2.1* we also use data from the 1960 census. All data refer to the 25+ population.

2000 Population Census. Labour Force Status of Population, Industry (Major Groups) of Employed Persons. Japan. Statistical tables presented in the report. Education. Table 12: Population 15 Years of Age and Over, by School Attendance and Type of Last School Completed (6 Groups), Age (Five - Year Groups), Marital Status (4 Groups) and Sex – Japan.

<http://www.e-stat.go.jp/SG1/estat/ListE.do?bid=000000030097&cycode=0>

2000 Population Census. Labour Force Status of Population, Industry (Major Groups) of Employed Persons. Japan. Statistical tables presented in the report. Education. Table 14: Persons Attending School and Persons Never Attended School, by School Level of Persons Attending School and Type of Persons Never Attended School (7 Groups), Age (Single Years) and Sex.

<http://www.e-stat.go.jp/SG1/estat/ListE.do?bid=000000030097&cycode=0>

2010 Population Census. Preliminary Tabulation. Preliminary Sample Tabulation. Education. Table 12. Population 15 Years of Age and Over, by School Attendance and Type of Last School Completed (6 Groups), Age (Five-Year Groups) and Sex - Japan, All Shi, All Gun, Prefectures, All Shi, and Shi and Ku with Population of 500,000 or More

<http://www.e-stat.go.jp/SG1/estat/ListE.do?bid=000001032402&cycode=0>

1960 Census. Table 6. Education. School Enrollment and Type of the Highest School Completed by Persons 15 Years Old and Over by Sex.

<http://www.e-stat.go.jp/SG1/estat/GL32020101.do?method=extendTclass&refTarget=toukeihyo&listFormat=hierarchy&statCode=00200521&tstatCode=000001036867&tclass1=&tclass2=&tclass3=&tclass4=&tclass5>

*Other useful links:*

Labour Force Survey. Basic Tabulation. Statistical table. Whole Japan. Quarterly. 2010, April to June.

<http://www.e-stat.go.jp/SG1/estat/OtherListE.do?bid=000000110001&cycode=2>

Historical Statistics of Japan. Chapter 2. Population and Households: Table 4: Population by Five-year age groups and sex.

<http://www.stat.go.jp/english/data/chouki/02.htm>

Statistics available in English:

<http://www.stat.go.jp/english/data/index.htm>

official statistics portal

<http://www.e-stat.go.jp/SG1/estat/eStatTopPortalE.do>

### *Estimation and fill-in procedure*

- We include in each educational level all those who have either completed it or are currently enrolled in it. For 1960 and 1970 we only have the total number of people over 25 who are currently enrolled in some educational institution, but we do not know the breakdown by level. To estimate it, we use the shares of each level in total enrollment in 1980.

- *L3.1* includes graduates of junior colleges and higher professional schools. There is not enough information to disaggregate *L2.2* into a vocational and an academic track.

- We interpolate between available observations to estimate missing ones at quinquennial intervals.

- To disaggregate *L1* and *L2.1* we proceed as follows. The 1960 census is the last one in which primary education and the first cycle of secondary education appear separated. We compute the ratio  $L1/(L1+L2.1)$  for 1960. To project it forward, we use the weight of the population who were 25 or more

in 1960 in the total population of each census year (1960, 1970, ... 2010) – i.e. we use the growth rate of this variable to project forward the value of the ratio of interest. This basically amounts to assuming that all "young people" (those below 25 in 1960) have completed compulsory schooling, and that persons with only primary schooling are a constant fraction of the surviving "old" population.

**Table A.30: Summary of data sources and fill-in procedure for Japan**

	1960	1965	1970	1975	1980	1985	1990	1995	2000	2005	2010
<i>L1</i>	C	int	est								
<i>L2.1</i>	C	int	est								
<i>L1+L2.1</i>	C	int	C								
<i>L2.2</i>	C	int	C								
<i>L3.1</i>	C	int	C								
<i>L3.2</i>	C	int	C								

- *Note:* See the discussion surrounding Table A.1 in the Australia section.

### 13. Netherlands

#### *Structure of the system and attainment categories*

- Primary school generally starts at the age of 4 or 5 and lasts until age 12. For purposes of calculating average years of schooling, we count only 6 years, starting at age 6, considering that the first two years would be equivalent to kindergarten in many other countries, which is not taken into account for our calculations.

- There are several tracks of secondary education, leading to different streams of post-secondary training in a complicated scheme that does not fit very well into our usual structure of upper and lower secondary and tertiary education. Pre-vocational education (*VMBO*) lasts for 4 years and leads to vocational secondary education (*MBO*), which can last up to four additional years. General secondary education (*HAVO*) lasts for 5 years and prepares students for higher professional education (*HBO*) provided by polytechnics, while pre-university education (*VWO*) lasts for 6 years and leads to studies in research universities (*WO*).

The Dutch Statistical office uses a grouping into five levels that we have adopted even though it corresponds to our classification scheme only roughly. *VMBO* and one-year *MBO* courses are grouped together in a category we have identified with *L2.1* and to which we have attributed a duration of 4 years. *HAVO*, *HBO* and *MBO* training of 2 to 4 years form another group which we have identified with *L2.2* and to which we attribute a total duration of 6 years (counting since the end of primary school). *HBO* and *WO* bachelor degrees are included in what we call *L3.1*, which is assumed to have a duration of 3 years after the completion of *L2.2*. *WO* masters and other postgraduate degrees are identified with *L3.2* and assigned a duration of 5 years.

- *Attainment categories* in 1960: *L2.1* = advanced elementary level; *L2.2* = secondary level; *L3.1* = semi-higher level and vocational colleges (in 1990).

- Descriptions of the Dutch educational system:

<https://webgate.ec.europa.eu/fpfis/mwikis/eurydice/index.php/Netherlands:Overview>  
[http://en.wikipedia.org/wiki/Education\\_in\\_the\\_Netherlands](http://en.wikipedia.org/wiki/Education_in_the_Netherlands)  
<http://www.government.nl/issues/education>  
<http://www.ibe.unesco.org/en/services/online-materials/ibedocs-en/national-reports.html>

Statistical Yearbook of the Netherlands 2004. Statistics Netherlands.  
<http://www.cbs.nl/nr/rdonlyres/3c60b3e9-09e0-491f-87f2-99b8e54936a1/0/2004a3pub.pdf>

#### *Data sources*

Dutch Statistical Yearbooks with data for 1960, 1971 and 1990 (presumably from the census but we are not sure) and data from the Labor Force Survey (LFS). The LFS data for 1995 were supplied by the Dutch Statistical Office for the previous version of this paper (D&D 2001). LFS data for 2001, 2005 and 2010 were downloaded from the Dutch Statistical Office's website.

Statline. Themes. Education. Education level. Labour force; level of education by ethnic background and age.

<http://statline.cbs.nl/StatWeb/publication/default.aspx?DM=SLEN&PA=71822ENG&D1=0&D2=0&D3=0>

- *Population of reference*: labor force in 1960; population over 14 not attending school in 1971 and 1990; population 15-64 in 1995 and population 25-64 in 2001, 2005 and 2010. Surprisingly, given the changes in the population of reference, there are no obvious breaks in the series.

- We use linear interpolation to fill in missing observations. We ignore unknowns (which are very few) when computing attainment shares.

- Within *L2.2*, we identify *MBO* training for 2 to 4 years with *L2.2voc* and the other two tracks with *L2.2ac*. We have data on these categories for 1971, 1990, 2001 and later years. We interpolate and extrapolate linearly to construct a complete quinquennial series for 1970-2010.

**Table A.31: Summary of data sources and fill-in procedure for the Netherlands**

	1960	1965	1970	1971	1975	1980	1985	1990	1995	2000	2001	2005	2010
<i>L1</i>	<b>Ybk</b>	int	int	<b>Ybk</b>	int	int	int	<b>Ybk</b>	<b>S</b>	int	<b>S</b>	<b>S</b>	<b>S</b>
<i>L2.1</i>	<b>Ybk</b>	int	int	<b>Ybk</b>	int	int	int	<b>Ybk</b>	<b>S</b>	int	<b>S</b>	<b>S</b>	<b>S</b>
<i>L2.2</i>	<b>Ybk</b>	int	int	<b>Ybk</b>	int	int	int	<b>Ybk</b>	<b>S</b>	int	<b>S</b>	<b>S</b>	<b>S</b>
<i>L3.1</i>	<b>Ybk</b>	int	int	<b>Ybk</b>	int	int	int	<b>Ybk</b>	<b>S</b>	int	<b>S</b>	<b>S</b>	<b>S</b>
<i>L3.2</i>	<b>Ybk</b>	int	int	<b>Ybk</b>	int	int	int	<b>Ybk</b>	<b>S</b>	int	<b>S</b>	<b>S</b>	<b>S</b>

- *Note*: See the discussion surrounding Table A.1 in the Australia section.

## 14. New Zealand

### *Structure of the system and attainment categories*

Education is compulsory between the ages of 6 and 16. Children typically enter primary school when they are 5 years old. Since this is one year earlier than in most countries, we will treat the first grade of primary schooling as a year of kindergarten and ignore it for purposes of calculating the cumulative

durations of the different school cycles. With this adjustment primary education has a duration of 7 years. It is followed by 5 years of secondary school. The boundary between *L2.1* and *L2.2* is fuzzy. We set it at the level of a 5<sup>th</sup> form qualification or school certificate or some equivalent qualification, which is the standard point of departure from school for those who do not want to go on to university. This gives *L2.1* a cumulative duration of 10 years. The cumulative duration of *L2.2* is of 12 years. Secondary schooling may be followed by secondary or post-secondary vocational training in a variety of training institutions or by enrollment at universities or polytechnics. Bachelor's degrees can generally be obtained after three years, but there are a large proportion of university graduates who have higher degrees, so we will attribute to *L3.2* a duration of 4 years.

Secondary students who fulfill the requirements can be awarded a secondary qualification (National Certificate of Educational Achievement, NCEA) ranging from level 1 at year 10 to level 3 at year 12. Post-school qualifications are awarded by the New Zealand Qualifications Authority. The authority has established a qualifications framework (NZQF) that classifies post-school qualifications into 10 levels, ranging from vocational training certificates and diplomas to post-graduate university degrees. (This framework replaces and systematizes earlier qualifications).

- We identify attainment levels with the following qualifications, as listed in different censuses:

*L1* = no qualifications, primary certificate.

*L2.1* = school certificate, 5<sup>th</sup> form qualification or NCEA level 1 certificate

*L2.2* = 6<sup>th</sup> form and higher school qualifications, university entrance or NCEA levels 2 and 3 certificates, overseas secondary school qualifications, other certificates + *L2.2 voc*

*L2.2 voc* = basic and skilled vocational qualifications, level 4 certificate, trade certificates and business college

*L3.1* = intermediate and advanced vocational qualifications, level 5 and 6 diplomas, professional and higher trade qualifications, diplomas and teacher's certificate

*L3.2* = bachelor or higher degree, level 7 qualification, masters or doctorate, postgraduate and honors degrees

For a description of New Zealand's educational system and qualification levels see for instance

[http://www.ibe.unesco.org/fileadmin/user\\_upload/Publications/WDE/2010/pdf-versions/New\\_Zealand.pdf](http://www.ibe.unesco.org/fileadmin/user_upload/Publications/WDE/2010/pdf-versions/New_Zealand.pdf)

[http://www.ibe.unesco.org/National\\_Reports/ICE\\_2004/newzealand.pdf](http://www.ibe.unesco.org/National_Reports/ICE_2004/newzealand.pdf)

<http://www.stats.govt.nz/Census/2006CensusHomePage/QuickStats/quickstats-about-a-subject/education-and-training/more-information.aspx>

<http://www.nzqa.govt.nz/studying-in-new-zealand/nzqf/understand-nz-quals/>

[http://en.wikipedia.org/wiki/Education\\_in\\_New\\_Zealand](http://en.wikipedia.org/wiki/Education_in_New_Zealand)

### ***Data Sources***

Censuses of 1966, 1986, 1991, 1996, 2001 and 2006 and data on the educational attainment of the population 25-64 for 2006 and 2008 from the website Education Counts, which seem to come from the Labor Force Survey.

2001 Census of Population and Dwellings. Work, Education and Income Tables. Table 21: Age Group and Sex by Highest Qualification for the Census usually resident population count, 2001.  
<http://www.stats.govt.nz/Census/2001-census-data/2001-census-work-education-income-tables.aspx>

2006 Census Data. Quickstats about education and training. Table 3: Highest qualification by sex and age group.  
<http://www.stats.govt.nz/Census/2006CensusHomePage/QuickStats/quickstats-about-a-subject/education-and-training.aspx>

1996 Census Data. Reference reports: Education. Downloadable Excel tables. Table 3: Highest qualification by sex and age group.  
<http://www2.stats.govt.nz/domino/external/pasfull/pasfull.nsf/web/Reference+Reports+Education+%28Census+96%29+1996?open>

1996 Census Data. Reference reports: Education. Table 1: Highest Qualification Gained for the Usually Resident Population, 1986-1996 Aged 15 Years and Over  
<http://www2.stats.govt.nz/domino/external/pasfull/pasfull.nsf/web/Reference+Reports+Education+%28Census+96%29+1996?open>

Census of population and Dwellings, 1966. Educational Qualifications of Labor Force. In New Zealand Official Yearbook, 1972.  
[http://www3.stats.govt.nz/New\\_Zealand\\_Official\\_Yearbooks/1972/NZOYB\\_1972.html#idsect1\\_1\\_60323](http://www3.stats.govt.nz/New_Zealand_Official_Yearbooks/1972/NZOYB_1972.html#idsect1_1_60323)

Census of population and Dwellings, 1971. Educational Qualifications of Labor Force. In New Zealand Official Yearbook, 1976.  
[http://www3.stats.govt.nz/New\\_Zealand\\_Official\\_Yearbooks/1976/NZOYB\\_1976.html#idsect1\\_1\\_60599](http://www3.stats.govt.nz/New_Zealand_Official_Yearbooks/1976/NZOYB_1976.html#idsect1_1_60599)

Education counts. Indicators. Educational attainment of the adult population. Table 2: Educational attainment of the population by highest level of qualification, 1997 a 2008.  
<http://www.educationcounts.govt.nz/indicators/main/education-and-learning-outcomes/1903>

New Zealand Official Yearbook  
[http://www.stats.govt.nz/browse\\_for\\_stats/snapshots-of-nz/nz-official-yearbooks.aspx](http://www.stats.govt.nz/browse_for_stats/snapshots-of-nz/nz-official-yearbooks.aspx)

- *Population of reference:* 25+ for 1996, 2001 and 2006; 15+ for 1986, 1991 and 1996; labor force for 1966 and 1971 and population 25-64 for 2006 and 2008.

- *Note:* There are data in the Yearbooks for other census years, including 1971 and 1981, but they appear to be inconsistent with the data we use. At least in some years, they refer to the highest level of school attended rather than to the qualifications obtained.

#### ***Estimation and fill-in procedure***

- Attainment shares for 1996, 2001 and 2006 are taken directly from census data for the population 25+ with the adjustment described below for those of unknown attainment. For 1986 and 1991 we only have data for the 15+ population. Rather than using it directly, we use the growth rates of the 15+ attainment shares between 1986 or 1991 and 1996 to project the attainment shares of the population 25+ backward from 1996. For this calculation we use a common growth rate for L2.2 and L3.1 since the data available to compute these growth rates lumps together secondary and post-secondary vocational qualifications and hence does not allow us to separate the two levels. To project the last available observation, that of 2006, to 2010, we use the annualized growth rate of attainment shares

between 2006 and 2008 using the Education Counts series. Using the 1966 observation for the labor force, we interpolate linearly between available observations to complete the series between 1966 and 2006 and extrapolate backward to estimate 1960 and 1965.

- *Treatment of unknown or not stated:* We impute those people whose schooling level is reported as unknown or unstated (between 5% and 15%) in proportion to the adjusted weights of the different attainment levels in the rest of the population. On the assumption that failure to answer or unclear answers are more likely for less educated people, these weights are adjusted as follows. First, we multiply the weight of *L1* by a coefficient of 2, those of *L3.1* and *L3.2* by 0.5 and leave the weights of the first and second cycle of secondary unchanged. Then we rescale the adjusted weights as needed so they add up to 100%.

**Table A.32: Summary of data sources and fill-in procedure for New Zealand**

	1960	1965	1966	1970	1975	1980	1985	1986	
<i>L1</i>	ext	ext	<b>C</b>	int	int	int	int	<b>est C</b>	
<i>L2.1</i>	ext	ext	<b>C</b>	int	int	int	int	<b>est C</b>	
<i>L2.2</i>	ext	ext	<b>C</b>	int	int	int	int	<b>est C</b>	
<i>L3.1</i>	ext	ext	<b>C</b>	int	int	int	int	<b>est C</b>	
<i>L3.2</i>	ext	ext	<b>C</b>	int	int	int	int	<b>est C</b>	
	1990	1991	1995	1996	2000	2001	2005	2006	2010
<i>L1</i>	int	<b>est C</b>	int	<b>C</b>	int	<b>C</b>	int	<b>C</b>	<b>est S</b>
<i>L2.1</i>	int	<b>est C</b>	int	<b>C</b>	int	<b>C</b>	int	<b>C</b>	<b>est S</b>
<i>L2.2</i>	int	<b>est C</b>	int	<b>C</b>	int	<b>C</b>	int	<b>C</b>	<b>est S</b>
<i>L3.1</i>	int	<b>est C</b>	int	<b>C</b>	int	<b>C</b>	int	<b>C</b>	<b>est S</b>
<i>L3.2</i>	int	<b>est C</b>	int	<b>C</b>	int	<b>C</b>	int	<b>C</b>	<b>est S</b>

- *Note:* See the discussion surrounding Table A.1 in the Australia section.

## 15. Norway

### *Structure of the system*

Mandatory education (between the ages of 6 and 16) comprises a 7-year course in primary school (*Barneskole*) followed by a 3-year course at a lower secondary school (*Ungdomsskole*). Compulsory schooling is followed by a 3-year upper secondary cycle. Upper secondary schools offer both general and vocational programs (which often include an apprenticeship at an enterprise). After completing upper secondary education, students can attend vocational colleges (*Fagskole*) which provide postsecondary vocational training courses lasting between 6 months and 2 years or enter a university or a college. These provide short (2-3 year) and long (5-year) degrees.

For further details see:

<https://webgate.ec.europa.eu/fpfis/mwikis/eurydice/index.php/Norway:Overview>

[http://en.wikipedia.org/wiki/Education\\_in\\_Norway](http://en.wikipedia.org/wiki/Education_in_Norway)

<http://www.regjeringen.no/en/dep/kd/Selected-topics/compulsory-education/the-norwegian-education-system.html?id=445118>

### *Data sources*

The Statistics Norway website contains two different series on educational attainment that display significant differences. One is taken from the 1994 Historical Statistics (HS, 1994) and the other from different editions of the Statbank database (*StatB*). The *HS* series (which was the one used in the previous version of this data set) starts in 1960 but refers only to the 16+ population and does not disaggregate university attainment into short and long courses. In this paper will rely primarily on the *StatB* series. This series starts in 1970, is taken from the census and the education register and provides a breakdown by age group that can be used to recover data for the 25+ population and disaggregates university attainment into two (or three) groups. Both *StatB* and *HS* report a single category for compulsory education, which corresponds to  $L1+L2.1$  without any further disaggregation. These series can be downloaded at:

Statistics Norway website, online database Statbank, Education. Education level of the population. [Persons 16 years and above, by sex, age and level of education \(new classification\) \(C\) \(1970 - 2010\)](http://statbank.ssb.no/statistikkbanken/Default_FR.asp?PXSid=0&nvl=true&PLanguage=1&tilside=selecttable/hovedtabellHjem.asp&KortnavnWeb=utniv)  
[http://statbank.ssb.no/statistikkbanken/Default\\_FR.asp?PXSid=0&nvl=true&PLanguage=1&tilside=selecttable/hovedtabellHjem.asp&KortnavnWeb=utniv](http://statbank.ssb.no/statistikkbanken/Default_FR.asp?PXSid=0&nvl=true&PLanguage=1&tilside=selecttable/hovedtabellHjem.asp&KortnavnWeb=utniv)

Statistics Norway website Historical Statistics 1994 (HS):  
<http://www.ssb.no/english/subjects/00/histstat/tables.html#education>

[http://www.ssb.no/utniv\\_en/](http://www.ssb.no/utniv_en/)

We also have data for  $L1$  in 1995 and 2009 taken from OECD/LFS and Unesco respectively. The first series refers to the population 25-64 and the second to the 25+ population.

UNESCO Institute for Statistics: Education. Statistical Tables: Educational attainment of the population aged 25 years and older. Latest year available.  
<http://stats.uis.unesco.org/unesco/ReportFolders/ReportFolders.aspx>

### *Estimation and fill-in procedure*

- For  $L1+L2.1$ ,  $L2.2$ ,  $L3.1$  and  $L3.2$ , our data are taken directly from *StatB* for the years 1970, 1980, 1985, 1990, 1995, 2000, 2005 and 2010. For  $L2.2$  and  $L3$  (=  $L3.1+L3.2$ ) figures for 1960 are obtained by projecting back the 1970 *StatB* observation using the growth rate between 1960 and 1970 of the corresponding *HS* observations.  $L1+L2.1$  is then recovered as a residual. To break down  $L3$  into  $L3.1$  and  $L3.2$  in 1960, we make use of the fact that the ratio  $L3.2/L3$  remains approximately constant over time. Hence the 1960 value of  $L3.2$  is obtained by applying the observed value in 1970 of the ratio  $L3.2/L3$  to the estimated value of  $L3$  in 1960. Linear interpolation is then used to fill in missing observations in 1965 and 1975.

- Labour Force Survey data supplied by the OECD for our previous paper gives a value of 1.54 for  $L1$  in 1995. This coincides approximately with the reading for the 35-44 age group. For 1975 we assume  $L1$  to be equal to the value observed for the 55-64 age group in 1995 (1.88) and for 2009 we use the

figure reported by UNESCO for primary attainment (0.30). We then interpolate and extrapolate between these three figures to estimate missing years.

- The fraction of the population whose attainment level is reported as unknown (which seems to be comprised mostly by immigrants who went to school abroad and as a result are not well captured by the education register) increases gradually over time, from 0.57% in 1970 to 5.97% in 2010. This group is ignored when calculating attainment shares.

**Table A.33: Summary of data sources and fill-in procedure for Norway**

	1960	1965	1970	1975	1980	1985	1990	1995	2000	2005	2009	2010
<i>L1</i>	ext	ext	ext	<b>Est Oecd</b>	int	int	int	<b>Oecd</b>	int	int	<b>Une</b>	ext
<i>L2.1</i>	ext	ext	ext	dif	int	int	int	dif	int	int	dif	ext
<i>L1+L2.1</i>	<b>est C</b>	int	<b>C</b>	int	<b>R</b>	<b>R</b>	<b>R</b>	<b>R</b>	<b>R</b>	<b>R</b>		<b>R</b>
<i>L2.2</i>	<b>est C</b>	int	<b>C</b>	int	<b>R</b>	<b>R</b>	<b>R</b>	<b>R</b>	<b>R</b>	<b>R</b>		<b>R</b>
<i>L3.1</i>	<b>est C</b>	int	<b>C</b>	int	<b>R</b>	<b>R</b>	<b>R</b>	<b>R</b>	<b>R</b>	<b>R</b>		<b>R</b>
<i>L3.2</i>	<b>est C</b>	int	<b>C</b>	int	<b>R</b>	<b>R</b>	<b>R</b>	<b>R</b>	<b>R</b>	<b>R</b>		<b>R</b>

- Note: See the discussion surrounding Table A.1 in the Australia section.

## 16. Portugal

### *Structure of the system*

Primary school (first and second cycle of *ensino básico*) lasts for six years, followed by three years of compulsory lower secondary education (third cycle of *ensino básico*). Upper secondary education (*ensino secundário*) also lasts for three years and offers both vocational and academic programs. There are also vocational training courses outside the formal school system that often involve an apprenticeship component. Higher education is provided by universities and polytechnics that offer both short and long degrees (*bachelorato*, followed by *licenciatura* after 3 or 4 years, and *mestrado* after one or two additional years). There are also some short post-secondary vocational courses (*cursos de especialização tecnológica*, CET) provided by a variety of training institutions.

<https://webgate.ec.europa.eu/fpfis/mwikis/eurydice/index.php/Portugal:Overview>

[http://en.wikipedia.org/wiki/Education\\_in\\_Portugal](http://en.wikipedia.org/wiki/Education_in_Portugal)

<http://www.euroeducation.net/prof/porco.htm>

### *Data Sources:*

We use data for the population 25+ taken from the National Censuses of 1981, 1991, 2001 and 2011, the Unesco Yearbook and the UN Demographic Yearbook.

Instituto Nacional de Estadística (1984). População residente segundo o grupo etario por nivel de instrucao e sexo. XII Recensamento Geral da População. Resultados definitivos, 1981. Total do país. Lisboa, p. 167.

[http://censos.ine.pt/xportal/xmain?xpid=INE&xpgid=censos\\_historia\\_pt\\_1981](http://censos.ine.pt/xportal/xmain?xpid=INE&xpgid=censos_historia_pt_1981)

Instituto Nacional de Estadística (1996). População residente segundo o grupo etario por nivel de instrucao e sexo. Censos 91. Resultados definitivos. Portugal. Lisboa, p. 201.

[http://censos.ine.pt/xportal/xmain?xpid=INE&xpgid=censos\\_historia\\_pt\\_1991](http://censos.ine.pt/xportal/xmain?xpid=INE&xpgid=censos_historia_pt_1991)

Instituto Nacional de Estadística (2002). População residente segundo o grupo etario por nivel de instrucao e sexo. Censos 2001. Resultados definitivos. Portugal. Lisboa, p. 304.

[http://censos.ine.pt/xportal/xmain?xpid=INE&xpgid=censos\\_historia\\_pt\\_2001](http://censos.ine.pt/xportal/xmain?xpid=INE&xpgid=censos_historia_pt_2001)

Instituto Nacional de Estadística (2011). Censos 2011. Resultados provisorios. População residente em Portugal segundo o nivel de instrucao mais elevado e completo em 1991, 2001, 2011. Lisboa, p. 22.

[http://censos.ine.pt/xportal/xmain?xpid=CENSOS&xpgid=ine\\_censos\\_publicacao\\_det&contexto=pu&PUBLICACOESpub\\_boui=122073978&PUBLICACOESmodo=2&selTab=tab1&pcensos=61969554](http://censos.ine.pt/xportal/xmain?xpid=CENSOS&xpgid=ine_censos_publicacao_det&contexto=pu&PUBLICACOESpub_boui=122073978&PUBLICACOESmodo=2&selTab=tab1&pcensos=61969554)

### *Estimation and fill-in procedure*

- *1981 to 2001*: we use data taken directly from the 1981, 1991 and 2001 censuses on the breakdown of the population by the highest educational level (started but not necessarily completed). We identify *L0* with the population with no formal schooling. We identify *L3.1* with “cursos medios” o “ensino medio” (which include such things as teacher training and nursing) except in 2001 when we also include short polytechnic courses known as *bacharelato*. In 1981 and 1991 *bacharelato* is lumped together with longer university courses (*licenciatura*) and is implicitly included in *L3.2*, which may be slightly biased upward as a result.

- *Note*: there are also data on those who have completed the different school cycles if we want to switch to the completion criteria.

- *Period 1960 to 1981*: We estimate attainments in 1960 and 1970 as indicated below and then interpolate between those two years and 1981 to complete the quinquennial series.

1) *Illiterates*: we use data on the population with no formal schooling from Unesco for 1960 and 1970.

2) *University*: We use data from Unesco in 1960 and 1970 interpreted as *L3.2* and DYB for 1960 interpreted as *L3*. In this way, we have observations for both *L3.1* and *L3.2* in 1960 and 1981. We calculate the ratio  $L3.2/L3$  in these two years and interpolate it to 1970, where we have a Unesco observation that we interpret as *L3.2*. Using the interpolated ratio and this observation, we estimate *L3.1* and *L3*. Finally, we interpolate for the rest of the years.

3) *Secondary*: We use data from Unesco in 1960 interpreted as *L2.2* and from DYB in 1960 and Unesco in 1970 for *L2*. In this manner we have observations for *L2.1* and *L2.2* in 1960 and 1981. We estimate *L2.2* in 1970 by interpolation between 1960 and 1981 and recover *L2.1* so that the sum  $L2.1+L2.2$  is consistent with the observation for *L2* available for 1970.

4) *L1* is calculated as a residual so that attainment shares add up to 100%.

- *Period 2001 to 2011*: Only preliminary results for the 2011 census have been published so far. The available data on educational attainment refers to the entire population (rather than to the population 25+) and to the highest level of schooling completed (rather than attained). On the other hand, the publication gives comparable data for 2001 which we have used to project forward the attainment shares of the 2001 census. We calculate the growth rates of completion shares between 2001 and 2011

and apply them to the 2001 attainment shares to estimate 2011 attainment shares. Since the preliminary estimate obtained in this way does not add up exactly to 100%, all attainment shares are adjusted in the same proportion so that this condition holds.

**Table A.34: Summary of data sources and fill-in procedure for Portugal**

	1960	1965	1970	1975	1980	1981	1985	
L0	<b>Une</b>	int	<b>Une</b>	int	int	<b>C</b>	int	
L1	dif	int	dif	int	int	<b>C</b>	int	
L2	<b>DYB</b>	int	<b>Une</b>	int	int	<b>C</b>	int	
L2.1	dif	int	est	int	int	<b>C</b>	int	
L2.2	<b>Une</b>	int	est	int	int	<b>C</b>	int	
L3	<b>DYB</b>	int	est	int	int	<b>C</b>	int	
L3.1	dif	int	est	int	int	<b>C</b>	int	
L3.2	<b>Une</b>	int	<b>Une</b>	int	int	<b>C</b>	int	

	1990	1991	1995	2000	2001	2005	2010	2011
L0	int	<b>C</b>	int	int	<b>C</b>	int	int	<b>Pr C</b>
L1	int	<b>C</b>	int	int	<b>C</b>	int	int	<b>Pr C</b>
L2	int	<b>C</b>	int	int	<b>C</b>	int	int	<b>Pr C</b>
L2.1	int	<b>C</b>	int	int	<b>C</b>	int	int	<b>Pr C</b>
L2.2	int	<b>C</b>	int	int	<b>C</b>	int	int	<b>Pr C</b>
L3	int	<b>C</b>	int	int	<b>C</b>	int	int	<b>Pr C</b>
L3.1	int	<b>C</b>	int	int	<b>C</b>	int	int	<b>Pr C</b>
L3.2	int	<b>C</b>	int	int	<b>C</b>	int	int	<b>Pr C</b>

- Note: See the discussion surrounding Table A.1 in the Australia section.

## 17. Spain

### *Structure and evolution of the system and attainment categories*

Primary education lasts for 6 years starting at age six and is followed by 4 years of compulsory lower secondary school (*Educación secundaria obligatoria, ESO*). At the upper secondary level, students can choose between an academic track (*Bachillerato*) and a vocational track (*Ciclos formativos de grado medio*), both lasting for two years. Post-secondary training includes a 2-year vocational track (*Ciclos formativos de grado superior*) in addition to universities, which offer both and short diplomas. Until recently, the first cycle of university studies (leading to the *diplomado* and similar degrees) lasted for 3 years while the second cycle degree (*licenciatura*) typically required five years of study. In recent years, 4-year *licenciaturas* have become more and more common. For further details, see for instance:

[http://en.wikipedia.org/wiki/Education\\_in\\_Spain](http://en.wikipedia.org/wiki/Education_in_Spain)

<http://www.wes.org/ewenr/02july/Practical.htm>

<https://webgate.ec.europa.eu/fpfis/mwikis/eurydice/index.php/Spain:Overview>

*Educational reforms since 1960*

The Spanish educational system has experienced numerous reforms over the last decades, some of which have affected the duration and even the nature of different school cycles. The most important reforms have been the one introduced in 1970 with minister Villar Palasí's Ley General de Educación (LGE) and the one resulting from the passing of the LOGSE act in 1990.

Table A.35 summarizes the structure of the Spanish educational system during the three periods separated by the cited reforms and gives the theoretical cumulative duration of the different school cycles during each period. The information used in the table comes from different editions of the reports of the Spanish Ministry of Education (ME, various years) regarding the Spanish educational system and from other publications, including MEC (1997), Diez Hochleitner et al (1977) and Fernández and González (1975).

**Table A.35: Structure of the Spanish educational system and theoretical cumulative durations of the different school cycles**

<i>Level:</i>	<i>before 1970</i>	<i>LGE, 1970-</i>	<i>LOGSE, 1990-</i>
<i>primary</i>	primaria: 4/6*	EGB I: 5	primaria: 6
<i>sec. 1</i>	bachillerato elemental: 8	EGB II: 8	ESO: 10
<i>sec. 2</i>	bach. superior & PREU: 11	BUP and COU: 12	bachillerato: 12
<i>FP 1/sec.</i>	oficialía industrial: 9	tecnico auxiliar: 10	ciclos grado medio: 12
<i>FP 2/sec</i>	maestría industrial: 11	técnico especialista: 12-13**	
<i>FP2/post-sec</i>			ciclos grado superior: 14
<i>univ. 1</i>	diplomatura/peritaje: 14	diplomatura/peritaje: 15	diplomatura/peritaje: 15
<i>univ. 2</i>	licenciatura: 16	licenciatura: 17	licenciatura: 17

*Notes:*

(\*) See the text.

(\*\*) This program started after BUP and did not require COU. It could also be accessed from the first cycle of FP after completing some additional materials that could be waived for those students displaying "sufficient professional maturity."

In the years before the 1970 reform, primary schooling lasted for six years and was followed by two cycles of vocational training (*Formación profesional*, FP) at the secondary level: *oficialía* and *maestría industrial*. Students had the option of leaving primary school after four years to enter an academic track lower secondary program (*bachillerato elemental*) that was followed by an upper secondary program comprising *bachillerato superior* and a pre-university course (*PREU*). Since the 1970 reform, primary school must be completed before entering secondary education and the first cycle of secondary schooling is mandatory and is followed by either the first cycle of vocational training (*FP I*) or by an academic program leading to university. The LOGSE reform of 1990 has extended the duration of primary schooling from 5 to 6 years and that of lower secondary schooling to (a cumulative total) of 10 years (up from 8) while shortening the second cycle of secondary schooling from four to two years. It has also changed the nature of the second cycle of vocational training which, following a substantial curriculum reform, goes from being a secondary program to a post-secondary one that can only be accessed by those having completed the new *bachillerato*. In recent years, the traditional 5-year *licenciatura* degrees offered by Spanish universities have tended to become shorter

(4-years) and, with the Bologna agreement, are being replaced by a 3+2 dual degree scheme (*grado + masters*). This is not shown in the table as its impact on the 25+ population is still minor.

#### *References:*

Diez Hochleitner, R., J. Tena Artigas and M. García Cuerpo (1977). *La reforma educativa española y la educación permanente*. Unesco, Paris.

Fernández de Pedro, S. and A. González de la Fuente (1975). "Apuntes para una historia de la Formación Profesional en España." *Revista de Educación*, julio-agosto, pp. 81-7, Madrid.

Ministerio de Educación (ME, varios años). *Las cifras de la educación en España. Estadísticas e indicadores*. <http://www.educacion.gob.es/mecd/jsp/plantilla.jsp?id=3131&area=estadisticas>

Ministerio de educación (ME, varios años). El sistema educativo español. <https://sede.educacion.gob.es/publiventa/directa.actionMinise>

Ministerio de Educación y Cultura (MEC, 1997). "Historia del sistema educativo español." Cap. 2 en Sistema Educativo Nacional España. Centro de Documentación e Investigación Educativa (CIDE), Organización de Estados Iberoamericanos para la Educación, la Ciencia y la Cultura (OEI). <http://www.oei.es/quipu/espana/index.html#sis>

- *Attainment categories*: The match of the different school cycles with our L0-L3.2 classification scheme is clear except perhaps in the case of vocational training (FP). Prior to the LOGSE reform, we include both levels of FP in secondary schooling. For the pre-LGE system, *oficialía* is included in L2.1 and *maestría* in L2.2voc. For the LGE system, both FP I and FP II are included in L2.2voc. After the LOGSE reform, however, we want to include the higher cycle of vocational training (*ciclos formativos de grado superior*) in L3.1. This poses a difficulty because the 2001 census (and the LFS) lump together this new cycle with the old FP II. We describe below how we have handled this problem.

#### *Data sources*

We use data for the population 25+ taken from the censuses of 1960, 1970, 1981, 1991, 2001 and from the Labor Force Survey (LFS) for 2005 and 2010. The censuses and the LFS are available online at the webpage of the Spanish National Statistical Institute at

Instituto Nacional de Estadística (INE, 2012a). *Encuesta de Población Activa*. In electronic database INEbase: Sociedad: Mercado Laboral. Madrid. [http://www.ine.es/inebmenu/mnu\\_mercalab.htm](http://www.ine.es/inebmenu/mnu_mercalab.htm)

Instituto Nacional de Estadística (INE, 2012a). Censos de población. In electronic database INEbase. Demografía y población. Madrid. [http://www.ine.es/inebmenu/mnu\\_cifraspob.htm](http://www.ine.es/inebmenu/mnu_cifraspob.htm)

#### *Estimation and fill-in procedure*

##### *Period 1960-2001*

- The 1960 census does not give a detailed breakdown of attainment levels by educational cycles and age groups (except for illiterates). Hence, we do not use this source (except for illiterates), and construct attainment estimates for 1960 through a backward projection using the 1970 census and the actual age structure of the population in 1960, correcting in the usual way for differential mortality across attainment levels. After doing this, we adjust L1 in 1960 so that the attainment shares in that

year, including *L0* (which is taken directly from the 1960 census rather than from the backward projection), add up exactly to 100.

The results for census years are shown in Table A.36. For 1960-2001, we interpolate to estimate missing observations.

**Table A.36: Attainment shares (%), estimates for census years**

	1960	1970	1981	1991	2001
<i>L0</i>	15.02	12.80	8.79	4.35	2.95
<i>L1</i>	78.55	78.58	71.81	61.20	39.97
<i>L2.1</i>	1.76	2.53	8.64	14.06	25.65
<i>L2.2</i>	1.76	2.33	3.87	11.84	17.36
<i>L3.1</i>	1.54	2.21	4.02	4.27	6.72
<i>L3.2</i>	1.36	1.55	2.86	4.28	7.36
<i>total</i>	100	100	100	100	100
<i>L2.2voc</i>		0.45	1.09	4.46	8.19

- *Note:* There is a change relative to the estimates in our earlier paper. We now use attainment shares based on the highest completed educational level. Our previous estimates were based on the highest educational level started but not necessarily completed in the case of the censuses of 1970 (and hence 1960) and 1981, and on completed levels from 1991 onward. The impact of the change is relatively small. The change is required to insure a consistent series because the 1991 and 2001 (and 1960) censuses only give data based on completed levels, whereas the 1970 and 1981 censuses provide information based on both criteria.

- *Treatment of the new second cycle of vocational education (ciclos formativos de grado superior).* As noted above, we want to include these studies in *L3.1* rather than in *L2.2voc* but face the difficulty that the Spanish census lumps together all the old and new second cycles of FP. The problem arises only in 2001 because prior to this year there are no graduates of the new FP II in the 25+ population. The implementation of the new FP has proceeded at an uneven pace in different regions. Graduates of the new program start to appear in the early 90s (in very small numbers at first). Since the expected age of completion of the program is 21 years, graduates would enter the 25+ population with a lag of four years. Hence, as of november 2001, the population of reference would include those graduates of the new FP II who completed their studies in the school year 1996-97 or earlier. We have estimated their numbers by adding up graduate flows for the courses 1991-92 to 1996-97 using data from the Spanish Ministry of Education (ME, 2012) on graduates of the new *ciclos formativos de grado superior*, including those on design and plastic arts and sports training. Their estimated number (67.384 persons) is subtracted from *L2.2voc* and added to *L3.1* using preliminary estimates of these magnitudes that do not differentiate between the old and new FP II.

- *Note:* For the 1970 census, we include in *L2.2voc* *maestría industrial* and *ATS* (lower-level nurse training). In the 1981 and 1991 censuses, we include in *L2.2voc* *maestría*, FP I and FP II.

ME (2012). Estadística de la Educación. Enseñanzas no universitarias. Alumnado. Resultados Académicos. Principales series. Alumnado que terminó los estudios por enseñanza / titulación. <http://www.educacion.gob.es/horizontales/estadisticas/no-universitaria/alumnado/resultados.html>

*Projections for 2005 and 2010*

- There are significant differences (of up to 5 points in attainment shares) between the Census and the LFS in 2001. As a result, LFS data for 2005 and 2010 are not used directly. Instead, 2001 attainment shares according to the census are projected to 2005 and 2010 using the observed growth rate between 2001 and each of these years according to the LFS data for the same age group. The estimates of attainment shares obtained in this manner are rescaled so they add up exactly to 100% in each year.

- For these calculations, all FP studies are included in L2.2 since the LFS seems to mix the old and new FP II in a single category. An ex-post correction for the new FP II is introduced using the same procedure described in the previous section. We accumulate flows of graduates of the new *ciclos formativos de grado superior* until four years before the date of interest. These totals are then subtracted from L2.2 and added to L3.1.

**Table A.37: Summary of data sources and fill-in procedure for Spain**

	1960	1965	1970	1975	1980	1981	1985
L0	C	int	C	int	int	C	int
L1	BP	int	C	int	int	C	int
L2.1	BP	int	C	int	int	C	int
L2.2	BP	int	C	int	int	C	int
L3.1	BP	int	C	int	int	C	int
L3.2	BP	int	C	int	int	C	int

	1990	1991	1995	2000	2001	2005	2010
L0	int	C	int	int	C	Pr S	Pr S
L1	int	C	int	int	C	Pr S	Pr S
L2.1	int	C	int	int	C	Pr S	Pr S
L2.2	int	C	int	int	C	Pr S	Pr S
L3.1	int	C	int	int	C	Pr S	Pr S
L3.2	int	C	int	int	C	Pr S	Pr S

- Note: See the discussion surrounding Table A.1 in the Australia section.

**Durations and average schooling**

Since the changes in the durations of some of the school cycles are significant, we will calculate the average years of schooling of the 25+ population taking into account these changes, i.e. attributing to each cohort of the adult population the duration of each cycle under the system with which they were educated.

Table A.38 gives the cumulative durations of the different cycles under each system that will be used to calculate average schooling. As usual, when there are several programs of the same level with different durations, we use the standard duration of the most common program for the entire cycle.

**Table A.38: Assumed cumulative durations of the different school cycles under different systems**

<i>Level:</i>	<i>before 1970</i>	<i>LGE, 1970-</i>	<i>LOGSE, 1990-</i>	<i>break point by date of birth</i>
<i>L0</i>	0	0	0	
<i>L1</i>	5	5	6	born in 1983
<i>L2.1</i>	8	8	10	born in 1983
<i>L2.2</i>	11	12	12	born in 1960
<i>L3.1</i>	14	15	15	born in 1960
<i>L3.2</i>	16	17	17	born in 1960

The table also gives the break points at which changes in durations take place, expressed in terms of the year of birth of the first cohort that experienced the change in duration. For instance, the LOGSE reform increased the duration of primary education from 5 to 6 years and that of the first cycle of secondary education from 8 to 10 years. The first cohort to go through the new primary program graduated in 1995-96 with 13 years and therefore was born in 1983. The same date of birth applies to the first (full) promotion of ESO graduates, who finished this cycle in 1999-2000 with 17 years of age.<sup>11</sup> Similarly, the LGE increased the duration of L2.2 and higher cycles by one year. This change applied for the first time to those born in 1960, who entered BUP in 1974-75, which is the year the old *bachillerato* disappeared (according to Spain's Statistical Yearbook).

Using the durations and the breakpoints given in Table A.38 we can calculate the average duration of each cycle that would apply in each census year, where we are averaging durations over segments of the population of different ages that were educated under different systems. For this, we have to divide the population 25+ at each census year that had completed each educational level into two groups: those born before and after the relevant breakpoint. Consider, for instance, the case of L2.2, whose duration was increased by LOGSE for all those born in 1960 and later years. Since this group does not enter the 25+ population until 1985, we use the old L2.2 durations in 1960, 1970 and 1981. In 1991, the first affected cohort is 31 years old, so we need to calculate the weight of the 31+ population with upper secondary attainment in the total 25+ population with upper secondary attainment to obtain the weight we should apply to the old duration of 11 years.<sup>12</sup>

Table A.39 gives the results of these calculations. The average durations shown in this table are then combined with the attainment shares constructed above to estimate average years of schooling in each census year. Finally, we interpolate between census years to complete the quinquennial series.

<sup>11</sup> Actually, there are some ESO graduates in earlier years because some regions started implementing this cycle before the latest allowed date, but we will ignore that.

<sup>12</sup> Since we don't have attainment data by single years of age, when necessary we assume that all cohorts included in a given age group have the same size. To approximate the population 25-31, for instance, we add to the population 25-29 two fifths of the population 30-34.

**Table A.39: Average durations of the different cycles in each census year**

	1960	1970	1981	1991	2001	2005	2010
<i>L0</i>	0	0	0	0	0	0	0
<i>L1</i>	5	5	5	5	5	5	5.02
<i>L2.1</i>	8	8	8	8	8	8	8.14
<i>L2.2</i>	11	11	11	11.39	11.63	11.67	11.74
<i>L3.1</i>	14	14	14	14.29	14.59	14.62	14.68
<i>L3.2</i>	16	16	16	16.34	16.63	16.68	16.74

## 18. Sweden

### *Structure of the system and attainment categories*

Primary and lower secondary education (provided at *Grundskola*) are compulsory between the ages of 7 and 16, but almost universally start at age 6 with the last year of pre-school. Hence, we will count ten years of compulsory education. Of these, three correspond to lower secondary education and the other seven to primary education. Upper secondary education is provided in *Gymnasieskola*, which offer both general and vocational programs lasting for 3 years. This is followed by post-secondary vocational training (*Yrkeshögskoleutbildning*), lasting for up to two years, or by higher education at universities (*universitet*) or university colleges (*högskola*). These institutions offer both short and long programs: a diploma after 2 years, bachelors after 3 and masters after 4 or 5.

We take as our measure of *L1* “primary and secondary education less than 9 years” which, according to Statistics Sweden’s SUN 2000 educational classification<sup>13</sup> includes “elementary school education” and “compulsory school education, years 1-6” among other possibilities. For *L3.1* we take “postsecondary education of less than 3 years” (ISCED levels 4 and 5B). *L3.2* includes anything over *L3.1*. It is not possible to separate *L2.2voc* from *L2.2 ac*. Attainment shares include those who have started but not completed each level.

<https://webgate.ec.europa.eu/fpfis/mwikis/eurydice/index.php/Sweden:Overview>

<http://www.svshv.umu.se/internationellt/SCB%20Education%20in%20Sweden.pdf>

[http://en.wikipedia.org/wiki/Education\\_in\\_Sweden](http://en.wikipedia.org/wiki/Education_in_Sweden)

### *Data sources*

National Statistical Yearbook with data for 1970 and data from the Swedish Education Register, both taken from the website of Statistics Sweden.

Statistics Sweden. Swedish Statistical Yearbook 1976. Table 379. Population by highest education by age and sex on nov. 1<sup>st</sup> 1970, p. 323.

<sup>13</sup> See <http://www.scb.se/statistik/UF/UF0506/SUN2000English%20version.doc>.

[http://www.scb.se/Grupp/Hitta\\_statistik/Historisk\\_statistik/Dokument/Statistisk%20årsbok%201914-2001/Statistisk%20årsbok%20for%20Sverige%201976.pdf](http://www.scb.se/Grupp/Hitta_statistik/Historisk_statistik/Dokument/Statistisk%20årsbok%201914-2001/Statistisk%20årsbok%20for%20Sverige%201976.pdf)

Statistics Sweden, online database: Finding Statistics: Statistical Database: Education and Research: Population 16-74 years of age by highest level of education, age and sex. Year 1985-2010.

<http://www.ssd.scb.se/databaser/makro/MainTable.asp?yp=tansss&xu=C9233001&omradekod=UF&omradetext=Education+and+research&lang=2&langdb=2>

- Population of reference: estimated 25+ in 1960 and 1970 and 25-74 from 1985 onward.

### *Estimation and fill-in procedure*

- The earliest available disaggregated data is for 1970 and refers to the population aged 25-60. We want to use this information (and census data on the age structure of the population) to estimate the attainment of the population 25+ in the same year and in 1960. First, we extrapolate attainment rates to older cohorts in 1970 as follows. Let  $h_{35-44}$  and  $h_{45-59}$  be the fraction of the population aged 35-44 and 45-59 which has attained a given level of education. Then, we estimate  $h_{60-75}$  and  $h_{75+}$  as follows:

$$h_{60-75} = h_{45-59} + 0.5 * (h_{45-59} - h_{35-44})$$

$$h_{75+} = h_{45-59} + (h_{45-59} - h_{35-44}).$$

With this, we can estimate attainments for ages 25+ in 1970, using the age structure of the population in that year. Next, we estimate 1960 using the same information and the age structure in 1960.

- For 1985-2010 we use Education Register data taken from the website of Statistics Sweden.

- We interpolate to complete the quinquennial series.

**Table A.40: Summary of data sources and fill-in procedure for Sweden**

	1960	1965	1970	1975	1980	1985	1990	1995	2000	2005	2010
<i>L1</i>	<b>BP</b>	int	<b>C</b>	int	int	<b>R</b>	<b>R</b>	<b>R</b>	<b>R</b>	<b>R</b>	<b>R</b>
<i>L2.1</i>	<b>BP</b>	int	<b>C</b>	int	int	<b>R</b>	<b>R</b>	<b>R</b>	<b>R</b>	<b>R</b>	<b>R</b>
<i>L2.2</i>	<b>BP</b>	int	<b>C</b>	int	int	<b>R</b>	<b>R</b>	<b>R</b>	<b>R</b>	<b>R</b>	<b>R</b>
<i>L3.1</i>	<b>BP</b>	int	<b>C</b>	int	int	<b>R</b>	<b>R</b>	<b>R</b>	<b>R</b>	<b>R</b>	<b>R</b>
<i>L3.2</i>	<b>BP</b>	int	<b>C</b>	int	int	<b>R</b>	<b>R</b>	<b>R</b>	<b>R</b>	<b>R</b>	<b>R</b>

- Note: See the discussion surrounding Table A.1 in the Australia section.

## **19. Switzerland**

### *Structure of the system*

In most cantons, primary school lasts for 6 years and is followed by 3 years of compulsory lower secondary school. Upper secondary school is divided into a general track that is offered in Baccalaureate and specialized schools (3 or 4 years) and a vocational track that offers both apprenticeships and full time classroom training at vocational schools (lasting 2 to 4 years). After secondary school, students can choose between universities and universities of applied sciences or

colleges of higher vocational education and training. Higher education programs typically last between 2 and 5 years.

<https://webgate.ec.europa.eu/fpfis/mwikis/eurydice/index.php/Switzerland:Overview>

[http://en.wikipedia.org/wiki/Education\\_in\\_Switzerland](http://en.wikipedia.org/wiki/Education_in_Switzerland)

[http://www.ond.vlaanderen.be/hogeronderwijs/bologna/links/documents/Higher\\_Education\\_in\\_Switzerland.pdf](http://www.ond.vlaanderen.be/hogeronderwijs/bologna/links/documents/Higher_Education_in_Switzerland.pdf)

### *Data sources*

We use data for the population 25+ supplied in part by Anna Borkowsky, from the Swiss Federal Office of Statistics. These data come from the censuses of 1960, 1970 (harmonized version), 1980 (harmonized version) and 2000, and from the Labor Force Surveys (LFS) of 1991, 1995 and 1999, and makes use of a 1994 survey for the International Adult Literacy Survey (IALS) to fill in certain gaps. In addition, we also use data from the 2000 census and from the 2000, 2005 and 2010 LFS. The 2000 Census and the most recent LFS data are available online at:

Recensement fédéral de la population 2000. Vie active, pendularité et formation. Fichiers Supplémentaires.

<http://www.bfs.admin.ch/bfs/portal/fr/index/news/publikationen.html?publicationID=2093>

Enquête suisse sur la population active (ESPA). Résultats détaillés de l'ESPA. Niveau de formation de la population résidante permanente selon le statut sur le marché du travail et les groupes d'âges

[http://www.bfs.admin.ch/bfs/portal/fr/index/themen/03/02/blank/data/03.html#parsys\\_00391](http://www.bfs.admin.ch/bfs/portal/fr/index/themen/03/02/blank/data/03.html#parsys_00391)

### *Estimation and fill-in procedure*

- *For 1995 and earlier years:* We reproduce with only minor adjustments the estimates supplied by Anna Borkowsky, from the Swiss Federal Office of Statistics for 1960, 1970, 1980, 1991 and 1995. In these data, the cutoff between *L1* and *L2.1* is set at 8 years of schooling (9 being required for inclusion in *L2.1*) and *L3.1* is equated with ISCED 5. The estimates include vocational training at the appropriate level. The 1994 IALS survey contains rather detailed data disaggregated by age group that are used to construct backward extrapolations and to make several corrections or refinements of the data provided by other sources for 1995 and earlier years, including the breakdown between *L1* and *L2.1*. To estimate attainment levels in 1965, 1975, 1985 and 1990, we interpolate linearly between the closest available years

- *For years after 1995:* Borkowsky also provides estimates for 1999 based on the LFS. The boundary between *L2.1* and *L2.2* is not always clear. LFS data for 1999 taken from the web of the Swiss Statistical Office is roughly consistent with Borkowsky's estimates for the same year provided we include "stage menager" and "formation professionnelle élémentaire" in *L2.1*. A limitation of the LFS data is that it only provides estimates of *L1+L2.1* and of *L3* (including higher vocational training). The 2000 census gives a breakdown of *L3* into *L3.1* and *L3.2* and is also roughly consistent with Borkowsky's estimates for 1999. Even so, sticking to LFS data for all years gives a more plausible time profile for the attainment series than using the census data for 2000. Hence, we prolong Borkowsky's series for

$L1+L2.1$ ,  $L2.2$  and  $L3$  using LFS data for 2000, 2005 and 2010. For 2000 we use the ratio  $L3.2/L3$  from the Census to disaggregate  $L3$  into sublevels and the ratio  $L2.1/L1+L2.1$  from Borkowsky's estimates for 1999 to separate  $L1$  from  $L2.1$ . We also assume that these ratios remain constant in 2005 and 2010 to break down  $L1+L2.1$  and  $L3$ . We use data from the second semester of each year.

**Table A.41: Summary of data sources and fill-in procedure for Switzerland**

	1960	1965	1970	1975	1980	1985	1990	1991	1995	2000	2005	2010
$L1$	Nat	int	Nat	int	Nat	int	int	Nat	Nat	est	est	est
$L2.1$	Nat	int	Nat	int	Nat	int	int	Nat	Nat	est	est	est
$L1+L2.1$										S	S	S
$L2.2$	Nat	int	Nat	int	Nat	int	int	Nat	Nat	S	S	S
$L3$										S	S	S
$L3.1$	Nat	int	Nat	int	Nat	int	int	Nat	Nat	est C	est C	est C
$L3.2$	Nat	int	Nat	int	Nat	int	int	Nat	Nat	est C	est C	est C

- Note: See the discussion surrounding Table A.1 in the Australia section.

## 20. United Kingdom

### *Structure of the system<sup>14</sup>*

Education is compulsory between the ages of 5 and 16. Primary education (ages 5 to 11) is followed by five years of mandatory lower secondary education that may include some vocational or technical subjects for pupils aged 14 or higher. At the end of lower secondary schooling students sit for a national exam known as the General Certificate of Secondary Education (GCSE), which replaces the GCE (General Certificate of Education) O-level exams. After completing compulsory schooling, students can choose between academic and vocational programs. Academic upper secondary programs typically last for two years and lead to the GCE A-level exams. Vocational upper secondary programs include apprenticeships and can lead to a variety of vocational qualifications after one or two years of study. Post-secondary education takes place at universities, colleges of technology and further education institutions that offer a variety of short and long programs leading to different certificates and degrees. The first university degree is generally a bachelors lasting for 3 years, and it is typically followed by a masters' after one or two additional years of study. A broad variety of secondary and vocational qualifications are offered by different institutions and are systematized in the National Qualifications Framework (NQF) that applies in England, Wales and Northern Ireland. Academic degrees are included in the Framework for Higher Education Qualifications (FHEQ) which is roughly aligned with the upper levels of the NQF. For further details see among others:

<https://webgate.ec.europa.eu/fpfis/mwikis/eurydice/index.php/United-Kingdom-England:Overview>

[http://en.wikipedia.org/wiki/Education\\_in\\_England](http://en.wikipedia.org/wiki/Education_in_England)

<sup>14</sup> This description applies to England. There are minor differences in Scotland, Wales and Northern Ireland.

[http://en.wikipedia.org/wiki/National\\_Qualifications\\_Framework](http://en.wikipedia.org/wiki/National_Qualifications_Framework)

<http://www.direct.gov.uk/en/EducationAndLearning/QualificationsExplained/index.htm>

- *Durations*: As in the case of New Zealand, children generally enter primary school at the age of 5. We treat the first year of primary school as kindergarten and don't take it into account for the calculation of average years of schooling. With this adjustment, primary schooling lasts for 5 years.

### *Data Sources*

For our previous paper, Peter Scrimgeour and Wilma Schofield, of the Education and Children Statistics service of the Scottish Executive, provided data for Great Britain obtained from the 1971, 1981 and 1991 censuses for *L1+L2* and *L3*. In addition, we have downloaded data from the ONS website for the 1961 and 2001 censuses for England and Wales and two different series based on LFS data for the entire UK (*LFS1* and *LFS2*).

1961 Census of England and Wales, Education Tables, Table 4: "Population aged 25 and over by 7 Terminal Education Age groups (10% sample)

[http://www.visionofbritain.org.uk/census/table\\_page.jsp?tab\\_id=EW1961EDU\\_M4&show=DB](http://www.visionofbritain.org.uk/census/table_page.jsp?tab_id=EW1961EDU_M4&show=DB)

*LFS1*: Measuring National Well-being - Education and skills data tables. Highest Level of qualification for those aged age 16–64. Using UN ISCED levels for international comparison as returned to Eurostat. United Kingdom (Percentages). 1993-2011.

<http://www.ons.gov.uk/ons/publications/re-reference-tables.html?edition=tcm%3A77-249007>

*LFS2*: Department of Education. The Level of Highest Qualification Held by Young People and Adults. Table 2 – Level of highest qualification held by people of working age in each UK country. Years 2000, 2005 and 2007

<http://www.education.gov.uk/cgi-bin/rsgateway/textsearch.pl?text=highest+qualification&type=init&search2.x=0&search2.y=0>

ONS Annual Population Survey 2010. In NOMIS. Official Labour Market Statistics. Labour Market Profile, Great Britain. Qualifications.

<https://www.nomisweb.co.uk/reports/lmp/gor/2092957698/report.aspx?#tabquals>

- *Population of reference*: Census: 25+ (except for 1971, which is 25-69); *LFS*: generally 16-64 (in some cases, 16-64 for men and 16-59 for women).

### *Estimation and fill-in procedure*

- The 1961 census breaks down the population 25+ by the age at which they left school, starting at age 14 or earlier. We assign those who left at 14 or earlier to *L1*, at 15 or 16 to *L2.1*, between 17 and 19 to *L2.2* and 20 and over to *L3*. We use the *L3* observation from the 1981 census, but disregard those from 1971 and 1991. Both of these observations are roughly consistent with those we keep (for 1961, 1981 and 1991) but would imply a slightly less plausible profile than interpolation between them, possibly in part because of changes in the age groups of reference across observations. For 1993 onward (1993, 1995, 2000, 2005 and 2010) we rely on the *LFS1* series for *L1*, *L2.1*, *L2.2* and *L3*. We interpolate between available data points (and extrapolate back to 1960) to construct full quinquennial series for these attainment categories starting in 1960.

- There are rather large differences between the 2001 census and nearby LFS observations, and significant (but not very large) differences between LFS1 and LFS2 that affect in particular the breakdown of *L2* and *L3* into their first and second cycles. We rely primarily on LFS1 because it provides a longer homogeneous series and because the classification scheme seems to be based on or at least consistent with the ISCED classification commonly used to make international comparisons, whereas LFS2 follows the NQF-FHEQ classification of qualifications.

- For *L3*, however, the classification used in LFS2 suits our purposes better. While *LFS1* includes short-duration university degrees (3-year bachelors programmes and shorter foundation or associate degrees) in the second cycle, *LFS2* includes in this category only long degrees (above bachelors level). We choose the latter classification scheme and assign a duration of 3 years to *L3.1* and of 5 years to *L3.2*.

- The problem with this is that LFS2 only gives us a breakdown of *L3* in 2000 and 2005. To extend the disaggregation to the rest of the period we proceed as follow. First, we observe that LFS1 and the available census provide what appears to be a roughly consistent series of *L3.2* (defined with the LFS1 criterion) for 1971, 1981, 1991, 1995 and 2000. We use the time profile of this series to project backward the 2000 observation of *L3.2* with the desired (LFS2) definition – that is, we use the growth rates of one *L3.2* series to project backward the other *L3.2* series. We proceed in the same way in the forward direction, using the growth rate of *L3.2* between 2005 and 2010 according to LFS1 to extend from 2005 to 2010 de *L3.2* series provided by LFS2. Having done this, we interpolate to complete the quinquennial series for *L3.2* and recover *L3.1* as the difference between our estimates of *L3* and *L3.2*. Finally, for 1960, 1965 and 1970, we keep constant the value of the ratio *L3.2/L3* observed in 1971 and apply it to each year's estimate of *L3* to obtain *L3.2*.

**Table A.42: Summary of data sources and fill-in procedure for the UK**

	1960	1961	1965	1970	1975	1980	1981	1985
<i>L1</i>	ext	<b>C</b>	int	int	int	int		int
<i>L2.1</i>	ext	<b>C</b>	int	int	int	int		int
<i>L2.2</i>	ext	<b>C</b>	int	int	int	int		int
<i>L3</i>	ext	<b>C</b>	int	int	int	int	<b>C</b>	int
<i>L3.1</i>	est	est	int	int	int	int	est	int
<i>L3.2</i>	est	est	int	int	int	int	est	int
	1990	1991	1993	1995	2000	2005	2010	
<i>L1</i>	int		<b>S</b>	<b>S</b>	<b>S</b>	<b>S</b>	<b>S</b>	
<i>L2.1</i>	int		<b>S</b>	<b>S</b>	<b>S</b>	<b>S</b>	<b>S</b>	
<i>L2.2</i>	int		<b>S</b>	<b>S</b>	<b>S</b>	<b>S</b>	<b>S</b>	
<i>L3</i>	int	<b>C</b>	<b>S</b>	<b>S</b>			<b>S</b>	
<i>L3.1</i>	int	est	est	est	<b>S</b>	<b>S</b>	est	
<i>L3.2</i>	int	est	est	est	<b>S</b>	<b>S</b>	est	

- Note: See the discussion surrounding Table A.1 in the Australia section.

- The LFS1 classification and its correspondence with our schooling levels is as follows: *L1* = no qualifications. *L2.1* = O levels, GCSE or equivalent and “other qualifications”, *L2.2* = A levels or equivalent. *L3.1* = higher education, no degree. *L3.2* = university degree or equivalent.

## 21. United States

### *Structure of the system*

There is considerable variation across states. Primary schools generally last between 4 and 6 years and are followed by middle schools or junior high schools (until grade 8 or 9) and by high school or senior high school until grade 12. While many high schools and senior high schools provide some vocational courses, there is no separate vocational training track at this stage and emphasis is mostly on general education. After high school, students can attend community colleges, colleges, universities and a variety of other training institutions that offer a wide range of degrees (from 2-year associate degrees to 4-year bachelors, and graduate degrees) and professional qualifications.

<http://www.ibe.unesco.org/en/worldwide/unesco-regions/europe-and-north-america/united-states/profile-of-education.html>

[http://en.wikipedia.org/wiki/Education\\_in\\_the\\_United\\_States](http://en.wikipedia.org/wiki/Education_in_the_United_States)

[http://en.wikipedia.org/wiki/Vocational\\_education\\_in\\_the\\_United\\_States](http://en.wikipedia.org/wiki/Vocational_education_in_the_United_States)

- *Attainment categories*: *L1* = 4 years of school completed or less; *L2.1* = 5-8 years; *L2.2* = 9-12 years; *L3.1* = 1-3 years of college; *L3.2* = more than three years of college.

### *Data sources*

We use data for the population 25+ for 1960-2010 at quinquennial intervals, taken from the Current Population Survey:

CPS Historical Time Series Tables. Table A-1. Years of School Completed by People 25 Years and Over, by Age and Sex: Selected Years 1940 to 2010

<http://www.census.gov/hhes/socdemo/education/data/cps/historical/index.html>

CPS data are quite close to census figures for the years in which both are available (1960, 1970, 1990 and 2000).

Since the data cover the entire period at 5-year intervals, there has been no need to estimate attainments.

- *other web pages of interest*:

Current Population Survey, Data on Educational Attainment:

<http://www.census.gov/hhes/socdemo/education/data/cps/index.html>

US Bureau of the Census, Data on Educational Attainment:

<http://www.census.gov/hhes/socdemo/education/data/index.html>

**Table A.43: Summary of data sources and fill-in procedure for the US**

	1960	1965	1970	1975	1980	1985	1990	1995	2000	2005	2010
<i>L1</i>	S	S	S	S	S	S	S	S	S	S	S
<i>L2.1</i>	S	S	S	S	S	S	S	S	S	S	S
<i>L2.2</i>	S	S	S	S	S	S	S	S	S	S	S
<i>L3.1</i>	S	S	S	S	S	S	S	S	S	S	S
<i>L3.2</i>	S	S	S	S	S	S	S	S	S	S	S

- Note: See the discussion surrounding Table A.1 in the Australia section.

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