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The impact of educational attainment on labor market outcomes

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Luxembourg Income Study Working Paper Series

Working Paper No. 475

The Impact of Educational Attainment on Labor Market Outcomes

Kalpana Pai

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Luxembourg Income Study (LIS), asbl

The Impact of Educational Attainment on Labor Market Outcomes

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This paper studies the impact of educational attainment on Labor Market outcomes using data from the Luxembourg Income Study (LIS) for 10 countries over a multi-year period. The 10 countries in this study include USA, Mexico, Germany, Netherlands, Italy, Finland, Spain, Norway, Australia, and Taiwan. We use person level data from the LIS for this study. By including 10 countries in the analysis, we are able to examine the differences in labor market returns in these countries. We are also able to analyze the gender difference in wages across these countries for low, medium, and high levels of educational attainment.

INTRODUCTION

The LIS is a non-profit cooperative research project with a membership that includes 30 countries on four continents. The LIS project began in 1983 under the joint sponsorship of the government of the Grand Duchy of Luxembourg and the Centre for Population, Poverty and Policy Studies (CEPS). The project is mainly funded by the national science and social science research foundations of its member countries. The LIS database includes Household Income Surveys. These surveys provide income, demographic, labor market and expenditure information on three different levels: household, person and child. This paper examines the impact of educational attainment on Labor Market outcomes using data from the Luxembourg Income Study (LIS) for 10 countries over a multi-year period.

The education systems and levels are defined differently across these 10 countries. When comparing educational levels across countries, it is therefore necessary to carefully look at these variables for each country, and eventually recode them to make them comparable. Each country-specific educational variable is transformed into a new variable (educ) with three comparable levels (low / medium / high).

The dependent variable in the regression model is the log of wages. The independent variables include age, age squared, and dummy variables for educational levels (low, medium and high). In order to differentiate between a multi-person household and a single person household, the regression model is weighted by the number of persons in the household. The weight of the household is spread over the household members thus taking into account the differences in household size. The regression models are estimated separately for males and

females to examine the gender gap in wages. The sample includes workers between the ages of 25 and 54, who have worked at least 35 hours per week, and for more than 47 weeks in the year.

By including 10 countries in the analysis, we will be able to examine the differences in labor market returns in these countries. We should also be able to analyze the gender difference in wages across these countries for the three levels of educational attainment. A number of studies have analyzed the relationship between education and wages. We would expect, on average, higher levels of education to be associated with higher wages.

The paper is organized as follows. Section 2 provides an overview of the Luxembourg Income Study. Section 3 provides the theoretical background and previous research investigating the relationship between educational attainment and labor market outcomes. Section 4 describes the data and methodology used in the analysis. Section 5 discusses preliminary study results. Finally, section 6 discusses study limitations and further research.

THE LUXEMBOURG INCOME STUDY

For over two decades the Luxembourg Income Study (LIS) has been involved in harmonizing national survey data on household incomes and income components (e.g., earnings) with a common conceptual framework.¹ By improving data comparability, LIS has achieved one of its major objectives: to facilitate cross-country comparisons of inequality, poverty and other distributional issues. While comparative analysis of income distributions was possible prior to the construction of LIS, the results were susceptible to the criticism that the data were insufficiently comparable, and the results from different studies could rarely be compared with any confidence.

The LIS project has reduced these uncertainties by establishing a “lowest common denominator” framework of data consistency, which permits ready comparability of results from analyses that employ the LIS data. By reducing data inconsistencies as an explanation for observed international differences in income distributions, LIS has improved both the confidence one can place in the results and the clarity of discourse about those results. Even when dealing with data series like educational attainment that cannot be readily harmonized, it is possible to isolate the definitional difficulty and clarify its importance.

LITERATURE REVIEW

It is well established that people with higher education earn more on average than those with less education. Becker introduced the basic idea of human capital investment in 1962. He put forth the idea that human capital and education in particular should be viewed as an investment and as such will have a rate of return associated with it. Mincer’s (1974) model of earnings became a cornerstone of empirical economics. The basic framework for returns to schooling is given below:

$$\ln Y = \beta_0 + \beta_1 S + \beta_2 X + \beta_3 X^2$$

Where

Y is the wage rate,

S is the amount of schooling, and

X is the work experience.

¹ More information can be found at www.lisproject.org

The model assumes that the only cost of schooling is the earnings forgone and that the length of one's life is independent of one's schooling. Some critics of Mincer's earnings approach say that ability, school quality and selectivity should not be ignored. People with higher abilities get a better education. Card and Krueger (1992) show that people who attend better schools obtain better education. In both these cases, there would be a biased upward effect on the coefficients that would be similar. People who choose more education are different from people who choose less education. Therefore, estimating one model for both sets of individuals would be limited.

There have been a few studies that have examined the changes in the rate of return to education over time. Psacharopoulos (1989) found that the private rate of return to education is around 10 to 15 percent in developed countries. The changes in the rate of return over time have been disputed since some countries show increasing trends while other show decreasing or even mixed trends.

Smeeding and Sullivan (1997) investigated the relationship between educational attainment and earnings inequality in eight nations using the LIS database. They concluded that among advanced economies there is no obvious relationship between the degree of earnings inequality and the percentage of the labor force attaining higher levels of education. Their second conclusion was that there is a clear positive correlation between the earnings differentials associated with greater educational attainment and the extent of earnings inequality.

Hartog et al. (2004) investigated the return to educational attainment and the risk of education for men in nine nations using the LIS database. They concluded that there was no obvious relationship between the earnings differentials and schooling attendance whereas it seemed that higher levels of educational attainment were associated with high levels of overall inequality. They found no unequivocal trend in the rates of return to education over time and that the residual variance might increase, decrease or have no relation at all with education or experience.

This paper aims to add to this literature by conducting a cross-national analysis using some of the same countries used by the Smeeding and Sullivan (1997), and Hartog et al. (2004) papers, but uses more recent data and some new countries. In addition, I examine the impact of educational attainment on wages for both men and women.

DATA AND METHODOLOGY

The data for this research come from the Luxembourg Income Study (LIS), a collection of national micro-level surveys on household income. All of the data sets that are part of LIS were collected within the respective countries, often by government agencies. When they are added to LIS, however, the data are "harmonized" in order to facilitate cross-national comparisons.²

The LIS database contains datasets from 30 nations; new datasets are added regularly (see Appendix 1). From these I have selected ten different nations with a wide range of institutional features. Nine of the countries included are members of the Organisation for Economic Co-operation and Development (OECD): Australia, Finland, Germany, Italy, Mexico, Netherlands, Norway, Spain, and the United States. I have also included one Asian member: the Republic of China (Taiwan). I chose these ten countries from among the longer list of possibilities because they all provide recent (2000) data including good measures of earnings, full-time work status and educational attainment (see Appendix 2).

² A "*harmonized*" LIS variable is a variable that exists (or may exist, depending on its actual presence in the original dataset) for each country, but whose coding differs in principle across countries. The harmonized variables are typically all the country-specific variables; the original classification is usually preserved.

In order to compare earnings distributions across nations we need to decide how to define the population, and how to measure earnings. Population and earnings data have been “harmonized” by LIS to ensure the highest feasible level of comparability. Similarly, we need to have some common definitions applied to disparate educational systems for a comparative analysis based on educational attainment. This section summarizes some of those decisions.

The LIS Surveys are typically household surveys, which report household income from a variety of sources, including earnings from wages and salaries, self-employment income, property income, private and public pensions, and means-tested transfers. Looking at persons rather than households, the surveys typically report for each earner a measure of annual earnings gross of taxes, including any employee’s share of social insurance contributions. The exceptions among the ten countries in this study are Italy, Spain and Mexico, which use a net earnings concept.

In order to address the problem that annual earnings differentials involve differences in both wages and hours, I limited the population of interest to workers who worked full time (generally 35 hours or more) during the survey period and reported full-time employment during 47 or more weeks. By doing so, I eliminated those who had substantial spells of unemployment or part-time employment. Because young workers are often still in training, while older workers are a self-selected group from among those who may be eligible for retirement, I have restricted the sample to persons aged between 25 and 54. After imposing the restrictions described below to isolate the full-year, full-time, prime-age labor participants, the samples sizes range from 93 (Spain) to 21264 (United States). Statistical results weight each sample observation with weights determined by the sampling frames of the original surveys. Results are reported separately by gender.

From the educational attainment data we distinguish three levels, which are coded as Low, Medium and High attainment. For the United States, the break between Low and Medium is the completion of high school, and that for the break between Medium and High is the completion of college. The descriptions of the education variable and subsequent coding into low, medium and high for all the countries in this study are given in Appendix 2.

PRELIMINARY RESULTS

I first examined data for the United States. Table 1 shows the composition of total and wage earning population by level of education. Over time, we can see that a larger percentage of the wage earning population is getting a higher education. The absolute returns to the higher levels of education are substantial and have increased over time. Figure 1 shows the average wages by level of education.

I conducted a similar analysis for Germany, The Netherlands, Italy and Spain. Tables 2 through 5 show these results. For Germany and the Netherlands, the increase in wage-earning population attaining higher levels of education is greater than for Italy and Spain. The returns to higher education are greater in Germany and Spain as compared to the Netherlands and Italy. The 1989 data for Germany refers to the former “West-Germany” only; 1994 and 2000 however refer to the reunified West and East Germany.

TABLE 1
COMPOSITION OF TOTAL AND WAGE EARNING POPULATION
BY LEVEL OF EDUCATION FOR THE US

		US86	US91	US94	US97	US00
Composition of total population by level of education	low	27.63 %	24.76 %	23.14 %	22.75 %	21.19 %
	medium	51.69 %	51.46 %	50.50 %	49.74 %	49.12 %
	high	20.68 %	23.78 %	26.36 %	27.51 %	29.69 %
Composition of wage earning population by level of education	low	17.90 %	15.63 %	14.65 %	14.79 %	13.81
	medium	56.48 %	55.30 %	53.36 %	52.05 %	51.06
	high	25.62 %	29.07 %	31.99 %	33.16 %	35.12
Average wage by level of education	low	9566	10533	11206	12960	14,209
	medium	15729(+64%)	18470(+75%)	20282(+81%)	23303(+80%)	26,804(+89%)
	high	26604(+69%)	32126(+74%)	36757(+81%)	42895(+84%)	50,361(+88%)

FIGURE 1
AVERAGE WAGES BY LEVEL OF EDUCATION FOR USA – 1986 TO 2000

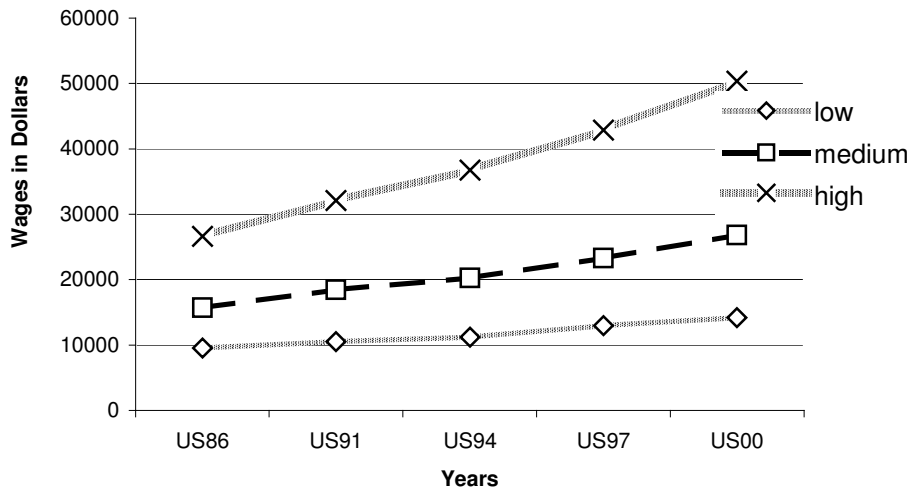


TABLE 2
COMPOSITION OF TOTAL AND WAGE EARNING POPULATION
BY LEVEL OF EDUCATION FOR GERMANY

		GE89	GE94	GE00
Composition of total population by level of education	low	27.48 %	22.20 %	17.51 %
	medium	52.66 %	53.70 %	51.63 %
	high	16.47 %	19.76 %	22.49 %
Composition of wage earning population by level of education	low	21.89 %	15.55 %	13.11 %
	medium	56.85 %	58.22 %	55.36 %
	high	19.92 %	24.76 %	27.02 %
Average wage by level of education	low	21326	25652	27108
	medium	34124(+60%)	37926(+48%)	40770(+50%)
	high	59065(+73%)	61394(+62%)	67975(+67%)

TABLE 3
COMPOSITION OF TOTAL AND WAGE EARNING POPULATION BY LEVEL OF EDUCATION FOR THE NETHERLANDS

		NL91	NL94	NL99
Composition of total population by level of education	low	44.48 %	40.64 %	27.16 %
	medium	33.14 %	34.55 %	38.97 %
	high	13.29 %	14.81 %	21.97 %
Composition of wage earning population by level of education	low	30.82 %	32.85 %	20.54 %
	medium	39.47 %	43.91 %	48.10 %
	high	18.77 %	20.81 %	30.30 %
Average wage by level of education	low	28989	30223	30990
	medium	39916(+38%)	42314(+40%)	46629(+50%)
	high	59049(+48%)	62410(+48%)	64365(+38%)

TABLE 4
COMPOSITION OF TOTAL AND WAGE EARNING POPULATION BY LEVEL OF EDUCATION FOR ITALY

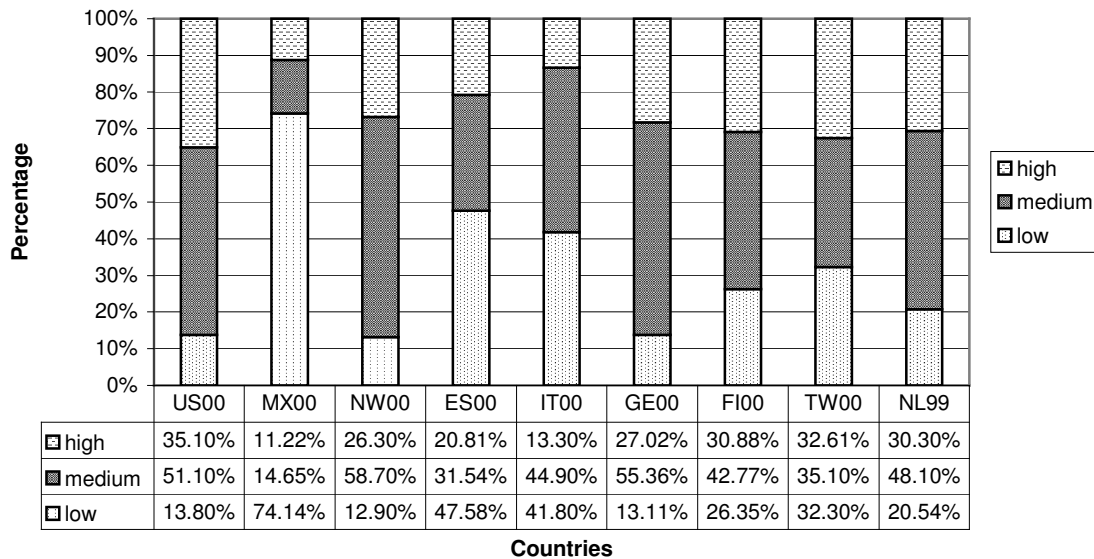
		IT87	IT91	IT95	IT00
Composition of total population by level of education	low	47.38 %	66.80 %	64.62 %	61.22 %
	medium	13.86 %	27.45 %	29.41 %	31.12 %
	high	4.31 %	5.75 %	5.97 %	7.66 %
Composition of wage earning population by level of education	low	58.08 %	50.34 %	46.68 %	41.81 %
	medium	31.97 %	38.96 %	42.49 %	44.93 %
	high	9.85 %	10.70 %	10.83 %	13.26 %
Average wage by level of education	low	13409	17111	18654	21,318
	medium	16588(+24%)	20705(+21%)	23128(+24%)	25,730(+21%)
	high	20672(+25%)	25295(+22%)	31072(+34%)	33,659(+31%)

TABLE 5
COMPOSITION OF TOTAL AND WAGE EARNING POPULATION BY LEVEL OF EDUCATION FOR SPAIN

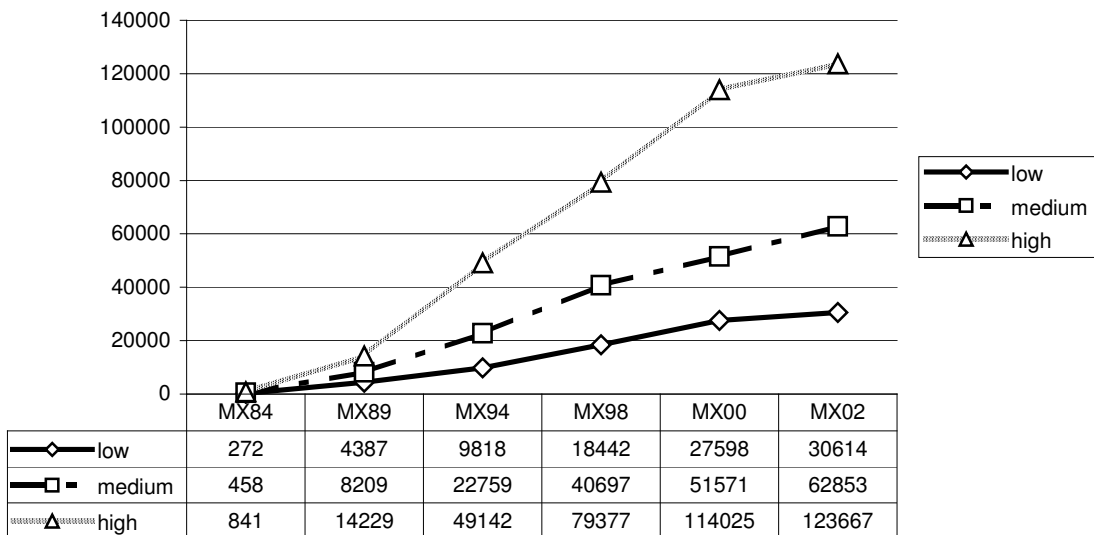
		ES90	ES95	ES00
Composition of total population by level of education	low	74.83 %	64.84 %	63.75 %
	medium	14.58 %	21.25 %	21.77 %
	high	10.59 %	9.63 %	13.02 %
Composition of wage earning population by level of education	low	63.21 %	53.06 %	47.58 %
	medium	16.94 %	27.84 %	31.54 %
	high	19.85 %	17.77 %	20.81 %
Average wage by level of education	low	973323	1350678	1602727
	medium	1193594(+23%)	1672187(+24%)	1966005(+23%)
	high	1766695(+48%)	2958779(+77%)	3157207(+61%)

Figure 2 depicts the composition of the wage earning population by level of education for year 2000 for nine of the countries. We can see that in USA, Taiwan, and European countries like Germany, Finland, Netherlands, and Norway, about two-thirds of the population have a medium or high level of educational attainment. This percentage is lower in Italy and Spain, but lowest in Mexico. Figure 3 plots average wages by level of education for Mexico. It is evident that the short supply of highly qualified individuals leads to a much larger return for the additional education.

**FIGURE 2
COMPOSITION OF WAGE EARNING POPULATION
BY LEVEL OF EDUCATION FOR THE YEAR 2000**



**FIGURE 3
AVERAGE WAGES BY LEVEL OF EDUCATION FOR MEXICO – 1984 TO 2002**



Next, I estimated a regression model where the dependent variable was the log of wages and the independent variables were age, age_squared, and dummy variables for medium and high levels of education. The omitted category is low level of education. This model was initially estimated for USA, Germany, the Netherlands, Italy and Spain. I would like to remind the readers that for Italy and Spain, net earnings are used. Table 6 shows these results.

As a whole, the returns to age and education explain better male rather than female wages as can be seen with the larger R squares. As expected, age has a positive effect on the wage rate. By estimating a quadratic equation in age, one allows for the effect of age to be nonlinear: it is positive but decreasing for both males and females (negative marginal effect). Again as expected, medium and high education have also a positive effect on wage rates with respect to low education for both males and females, with high education having a much stronger effect than medium.

As to the gender difference, we can see that age is more important for males, while education is more important for females in explaining their wage rates. As a result, the educational returns seem to be higher for females than for males.

One should note, however, that education is not truly independent in this simple setting. Highly motivated individuals will choose to pursue more education than others. By the same token, highly motivated individuals might do things that, on average, lead them to have higher wages. If so, does a positive coefficient for high education that suggests an association between wages and education really measure the effect of high education on wages, or does it reflect the effect of some underlying effect on both variables that we have not included in this regression model?

LIMITATIONS AND FURTHER RESEARCH

As mentioned earlier, these results are preliminary. I need to conduct the analyses for all 10 countries. For countries that have number of years of education rather than level attained, the data need to be recoded to match one of the three categories of low, medium or high. In addition, I would like to add a rural/urban indicator to see if there are any geographic effects. I also plan to compute the gender wage gap. I would like to estimate the regression models again using experience and experience_squared instead of age, along with education levels, using Mincer's approach.

TABLE 6
IMPACT OF EDUCATIONAL ATTAINMENT ON WAGES BY GENDER (PARAMETERS BY COUNTRY AND YEAR)
DEPENDENT VARIABLE: LOG WAGES

Country & Year	Constant		Age		Age_Squared		Medium level of education		High level of education		Observations	R-square
	Coeff	t-stat	Coeff	t-stat	Coeff	t-stat	Coeff	t-stat	Coeff	t-stat		
MALES												
US86	0.0611	0.28	0.0861	6.89	-0.0009	-5.45	0.3441	8.06	0.6064	13.44	3611	0.1828
US91	0.2426	2.39	0.0820	15.25	-0.0008	-11.95	0.3527	23.94	0.6773	44.49	19567	0.2213
US94	0.3967	4.15	0.0759	15.10	-0.0007	-11.47	0.3377	24.49	0.6981	48.41	21264	0.2175
US97	0.6544	5.96	0.0672	11.62	-0.0007	-8.81	0.3745	21.24	0.7316	40.09	17776	0.1951
US00	0.8544	7.76	0.0634	11.00	-0.0006	-8.66	0.3849	25.11	0.7950	48.78	18622	0.2001
GE89	1.8517	6.49	0.0443	2.83	-0.0004	-2.10	0.1486	6.35	0.3543	8.63	1993	0.1411
GE94	2.5058	8.18	0.0201	1.28	-0.0001	-0.63	0.0109	0.39	0.2965	8.41	2513	0.1198
GE00	2.3231	9.69	0.0363	2.92	-0.0003	-2.24	0.0449	1.29	0.3222	8.12	3773	0.1124
NL91	1.9554	7.70	0.0463	3.40	-0.0004	-2.30	0.1319	5.09	0.4067	16.39	1561	0.1700
NL94	1.4670	6.55	0.0750	6.31	-0.0008	-5.02	0.1209	6.27	0.3671	16.65	1953	0.2915
NL99	1.3353	6.22	0.0816	7.42	-0.0008	-5.89	0.1484	7.10	0.3862	16.31	1921	0.3053
IT95	1.0554	5.00	0.0524	4.68	-0.0005	-3.38	0.2153	11.73	0.4578	10.00	2603	0.2273
IT00	0.8310	2.80	0.0697	4.61	-0.0007	-3.70	0.1788	7.29	0.3420	7.32	2676	0.1348
ES95	6.2577	7.01	-0.0056	-0.11	0.0003	0.46	0.2431	2.88	0.6136	5.27	243	0.1955
ES00	5.7788	18.77	0.0356	2.14	-0.0002	-1.01	0.2691	9.27	0.5987	18.48	1762	0.2300
FEMALES												
US86	0.8640	3.86	0.0393	3.26	-0.0004	-2.75	0.2812	7.86	0.6369	16.62	2316	0.1582
US91	0.7427	7.16	0.0496	9.16	-0.0005	-7.81	0.3696	19.67	0.7284	37.52	14538	0.1805
US94	0.5664	5.22	0.0569	10.05	-0.0006	-8.36	0.4281	20.55	0.8204	38.66	15889	0.1887
US97	0.8260	7.20	0.0495	8.31	-0.0005	-6.85	0.3957	20.62	0.7952	40.30	13424	0.1850
US00	1.1353	8.97	0.0375	5.79	-0.0004	-4.64	0.4252	19.96	0.8417	39.60	14001	0.1889
GE89	1.9791	5.83	0.0324	1.84	0.0004	-1.60	0.1896	3.60	0.4106	6.74	712	0.1394
GE94	2.8170	9.01	-0.0027	-0.16	0.0001	0.61	0.0778	1.67	0.1630	2.28	1153	0.0381
GE00	2.6973	7.66	0.0044	0.24	0.0000	0.13	0.1840	3.82	0.3907	7.94	1651	0.0783
NL91	1.8243	2.55	0.0472	1.21	-0.0004	-0.83	0.0161	0.23	0.2771	4.84	302	0.0931
NL94	1.4164	3.96	0.0804	4.02	-0.0009	-3.55	0.1291	2.90	0.2998	6.68	483	0.1969
NL99	1.3383	2.92	0.0739	2.93	-0.0008	-2.39	0.3033	3.67	0.4593	5.62	506	0.1900
IT95	1.3951	4.71	0.0282	1.79	-0.0002	-0.96	0.2517	9.32	0.3748	6.17	1181	0.1684
IT00	0.9222	3.34	0.0629	4.39	-0.0007	-3.60	0.1831	7.71	0.3263	5.58	1326	0.1596
ES95	5.2748	4.55	0.0403	0.62	-0.0004	-0.47	0.4728	3.50	0.7580	5.35	93	0.2608
ES00	5.2101	13.99	0.0546	2.73	-0.0005	-1.86	0.3405	7.78	0.6721	15.08	834	0.3222

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APPENDIX 1

LIS Members

Australia, Austria, Belgium, Canada, Czech Republic, Denmark, Estonia, Finland France, Germany, Greece, Hungary, Ireland, Israel, Italy, Luxembourg, Mexico, Netherlands, Norway, OECD, Poland, ROC Taiwan, Romania, Russia, Slovak Republic, Slovenia, Spain, Sweden, Switzerland, United Kingdom, United States.

APPENDIX 2

Narrative Descriptions and Coding of Educational Attainment

Country	Description	Level of Education coded as
United States	No schooling	Low
	Elementary school	Low
	Some high school	Low
	High school diploma	Medium
	Some college	Medium
	Associates Degree	Medium
	Bachelors Degree	High
	Masters Degree	High
	Doctorate	High
Germany	No degree	Low
	Other degree	Low
	Other degree with technical	Low
	Secondary	Low
	Secondary with technical	Medium
	Nonclass secondary	Low
	Nonclass secondary with technical	Medium
	Technical school degree	Medium
	Technical school with technical	Medium
	High school degree	Medium
	High school with technical	Medium
	Technical college	High
	University	High
The Netherlands	Pre-primary	Low
	Primary	Low
	Secondary lower	Low
	Secondary Higher	Medium
	Tertiary lower	High
	Post-graduate or old masters	High
Italy	None	Low
	Elementary school	Low
	Middle school	Low
	Secondary profession	Medium
	High school (5 yrs)	Medium
	Associates degree / short	High
	Bachelors degree	High
	Post graduate qualification	High

APPENDIX 2 Continued

Narrative Descriptions and Coding of Educational Attainment

<u>Country</u>	<u>Description</u>	<u>Level of Education coded as</u>
Spain	Illiterate	Low
	Without formal education	Low
	Basic education	Low
	Primary education	Low
	Secondary education	Medium
	University preparation	Medium
	Basic technical education	Medium
	Adv. technical education	High
	Basic university	High
	Advanced university	High
Republic of China (Taiwan)	Illiterate	Low
	Supplementary schooling	Low
	Primary school	Low
	Junior vocational	Low
	Junior high	Low
	Senior vocational (part)	Low
	Senior vocational (grad)	Medium
	Senior high (part)	Low
	Senior high (grad)	Medium
	Junior college (part)	Medium
	Junior college (grad)	Medium
	College/University (part)	Medium
	College/University (grad)	High
	Grad school (part)	High
	Grad school (grad)	High
Australia	Never went to school	Low
	Less than secondary	Low
	Completed secondary	Medium
	Trade Certificate	Medium
	Other Certificate	Medium
	Bachelor or Higher	High
	Other	Medium

APPENDIX 2 Continued

Narrative Descriptions and Coding of Educational Attainment

Country	Description	Level of Education coded as
Finland	No Education/Unknown/<9 Years	Low
	10-11 Years	Medium
	12 Years	Medium
	13-14 Years	High
	15 Years	High
	16 Years	High
	Post-Graduate Education	High
Norway	Unknown	Low
	None, preschool	Low
	1-6 years	Low
	7-9 years	Low
	10 years	Medium
	11-12 years	Medium
	13-14 years	High
	15-16 years	High
	17-18 years	High
	Over 18 years	High
Mexico	No education	Low
	Preprimary	Low
	1° primary	Low
	2° primary	Low
	3° primary	Low
	4° primary	Low
	5° primary	Low
	6° primary	Low
	1° secondary	Low
	2° secondary	Low
	3° secondary	Low
	Preparatory, vocational or normal incomplete	Medium
	Preparatory, vocational or normal complete	Medium
	Superior incomplete	Medium
	Superior complete	High
Postgraduate	High	