

Chapter 7

Skills and Economic Outcomes

Summary

This chapter examines economic outcomes associated with differences in observed skills. First, the rewards to literacy, numeracy and problem solving skills on labour markets are studied with a structural model that specifies the joint determination of personal earnings, education and cognitive skills. Second, the likelihood of receiving social assistance transfers for individuals at different skill levels is estimated. This latter analysis adjusts for education, age, gender and household income levels. Similarly, findings on the likelihood of earning investment income for respondents at different skill levels are presented.

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Skills and Economic Outcomes

7.1 Overview and highlights

This chapter examines economic outcomes associated with differences in observed skills. First, the rewards to literacy, numeracy and problem solving skills on labour markets are studied with a structural model that specifies the joint determination of personal earnings, education and cognitive skills. Second, the likelihood of receiving social assistance transfers for individuals at different skill levels is estimated. This latter analysis adjusts for education, age, gender and household income levels. Similarly, findings on the likelihood of earning investment income for respondents at different skill levels are presented.

Key findings of these analyses are:

- Skills have a large effect on earnings in the majority of countries. The extent to which economic rewards are attributable to either skill or education is mixed and varies by country.
- In Bermuda and Italy, the returns to skill overshadow the effect of education. After accounting for individual skills, wage returns to education are either zero or negative. This suggests that adults with additional years of schooling who do not display a commensurate level of skill are not rewarded for their additional schooling on the labour market.
- In Canada and the United States, the labour market appears to separately reward both the skills measured in ALL and additional schooling.
- In Norway, the findings indicate that both education and skill are valued, but with a higher relative return accruing to the latter. In fact, the labour market returns to numeracy overshadow the return to education. Hence if well-educated adults lack in numeracy skill then they derive no benefit from any additional years of schooling.
- Results suggest that the labour market in Switzerland does not reward prose, document, numeracy or problem solving skills separately from

years of schooling. Skills are only rewarded in so far as adults who have completed additional years of schooling also have higher skill proficiencies.

- Despite the strong associations between skill and economic outcomes reported above, there are significant proportions of workers who have medium to high levels of skill but who nevertheless occupy low-paying jobs. Naturally the opposite is also true. There are low to medium skilled workers who are nevertheless well paid.
- Low-skilled respondents are more likely than high skilled respondents to receive social transfers in half of the countries surveyed. This is the case in Canada, Norway and the United States, even after adjusting for education as well as age, gender and household income. This relationship is not significant in Bermuda, Italy and Switzerland.
- Not surprisingly, since medium to high skilled adults tend to be paid higher wages, they also have more opportunity to accumulate capital. Hence they are more likely than low skilled workers to have investment income on top of their wage earnings. This is the case in Bermuda, Canada, Switzerland and the United States. In Italy, however, this relationship is not significant once the effect of education and household income have been taken into account.

7.2 Earnings returns to skills and education

According to neo-classical economic theory, individuals who contribute more to the final value of production are expected to earn more. Furthermore, the theory of human capital suggests that the relative contribution of individuals depends on the knowledge, skills and other attributes embodied within them (Schultz, 1961; Becker, 1964; Blaug, 1976). Education plays an important role by imparting skills and also by providing easy to observe information about skills on the labour market (Stigler, 1961; Arrow, 1973; Spence, 1973). Thus education and skills are expected to influence the distribution of economic rewards. Previous research indeed supports the notion that skills are rewarded on the labour market (Rivera-Batiz, 1992; Murnane, Willet and Levy, 1995; OECD and HRDC, 1997; Osberg, 2000; Green and Riddell, 2001; Murnane, *et al.*, 2001). This section examines the extent to which the skills measured in ALL are rewarded by labour markets.

Figure 7.1 compares the labour market returns attributable to skill with those accruing to schooling. Results are obtained in a multivariate model that specifies the joint determination of earnings, education and skills (see Box 7A). Because prose and document literacy, numeracy and problem solving skills are highly correlated, four models, each focusing on a particular skills domain, are estimated. Each adjusts for years of schooling and several other factors such as age, experience, community size, language status and gender. The findings confirm labour markets are unique in the sense that they reward schooling and skills differently.

When interpreting the results it is important to note that the potential effects of education on the development of skills measured in ALL are fully taken into account. Each additional year of schooling is estimated to raise an individual's ranking in the distribution of skills by a substantial amount. Thus for the purposes of this analysis, it is useful to attribute any remaining effects of education on

earnings to other unobserved skills not measured in ALL, such as communication skills, leadership or entrepreneurial skills, as well as attitudinal factors.

In Bermuda and Italy, the returns to skill overshadow those accruing to education. This suggests that skills are highly valued on the labour market and that education is rewarded only in so far as it is associated with these skills. For example, every increase of 10 percentiles in the ranking of the distribution of prose, document, numeracy or problem solving skills is associated with between 15 to 55 per cent higher weekly earnings, depending on the skill domain considered. Returns to education that are not statistically different from zero or are negative imply that if additional years of schooling are not associated with higher skill proficiencies, then those extra years of schooling are not rewarded on the labour market.

In Canada, Norway and the United States, there is evidence that the labour market directly rewards both the observed skills in ALL and other unobserved skills associated with schooling. The results for Canada are consistent with previously reported findings that use data from IALS (see Green and Riddell, 2001). Skills of the type measured in ALL are rewarded separately from schooling, ranging from about seven to 11 per cent for every increase of 10 percentiles in the ranking of distributions, depending on the skill domain. Also, each additional year of schooling is on average associated with about five per cent higher weekly earnings even after adjusting for directly observed skills. This suggests that the Canadian labour market rewards schooling above and beyond its effect on the development of cognitive skills. The results are similar in the United States with returns ranging from six to nine per cent.

Returns to skills in Norway range from eight to 15 per cent, depending on the domain. The returns to skill are also larger relative to the return to years of schooling. This is especially the case for numeracy skills. This suggests that in the Norwegian context, additional years of schooling are only rewarded if they are also associated with higher numeracy skills.

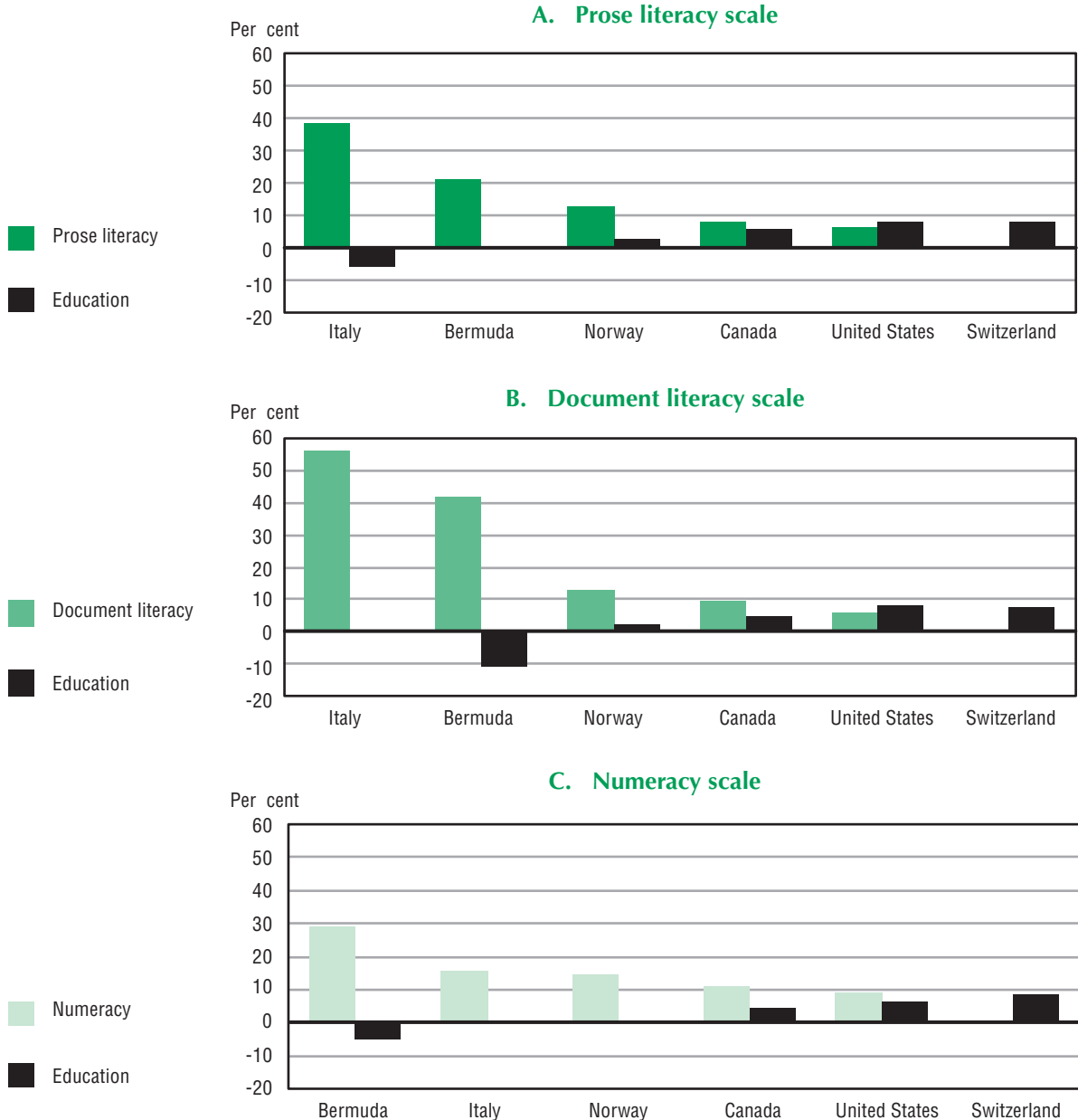
Finally, results suggest that the labour market in Switzerland does not reward prose, document, numeracy or problem solving skills separately from education. Skills are only rewarded when adults have also completed an expected corresponding number of years of schooling. Accordingly, those in high paying jobs have more years of schooling on average, but skills of the type measured in ALL are more evenly distributed among high and low paying jobs compared to other countries.

Findings reported in Figure 7.2 suggest that skills and education alone do not fully explain who benefits from high wages – occupation also plays an important role in the wage determination process. High-skill occupations such as experts, managers, and high-skill information jobs are on average well-paying jobs in all countries. These are also jobs that require higher engagement in reading, writing and numeracy tasks (see Figure 6.5). Thus the expectation is that literacy and numeracy skills are rewarded systematically, but it is shown in Chapter 6 that there is a degree of possible “mismatch” between the literacy and numeracy skills of individuals and the extent to which workers are required to engage in reading, writing and numeracy tasks at work.

FIGURE 7.1

Returns to skills and education

Per cent increase in weekly earnings per increase of 10-percentiles on the prose, document, numeracy and problem solving scales, and per increase of additional year of schooling, adjusted three stage least squares model¹, labour force populations aged 16 to 65, 2003



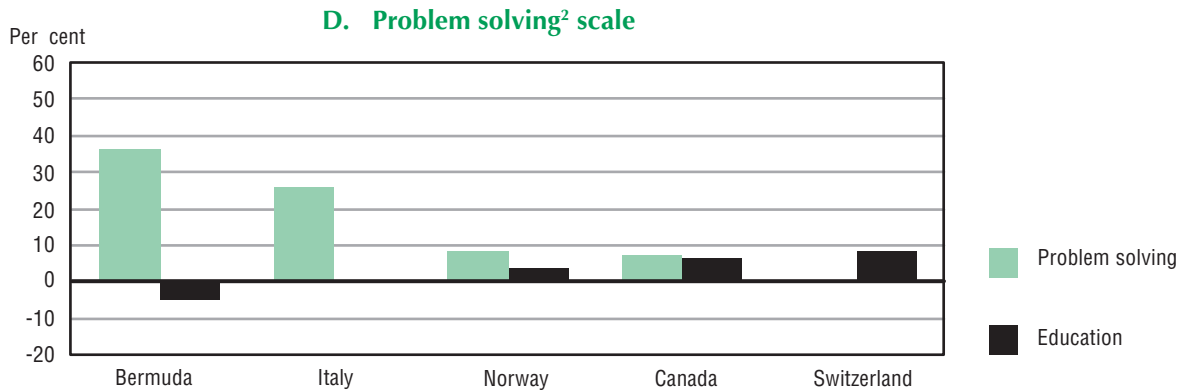
- A. Countries are ranked by the effect of prose literacy.
- B. Countries are ranked by the effect of document literacy.
- C. Countries are ranked by the effect of numeracy.

Source: Adult Literacy and Life Skills Survey, 2003.

FIGURE 7.1 (concluded)

Returns to skills and education

Per cent increase in weekly earnings per increase of 10-percentiles on the prose, document, numeracy and problem solving scales, and per increase of additional year of schooling, adjusted three stage least squares model¹, labour force populations aged 16 to 65, 2003

**D. Countries are ranked by the effect of problem solving.**

1. See Box 7A.
2. Switzerland (Italian) and the United States did not field the problem solving skills domain.

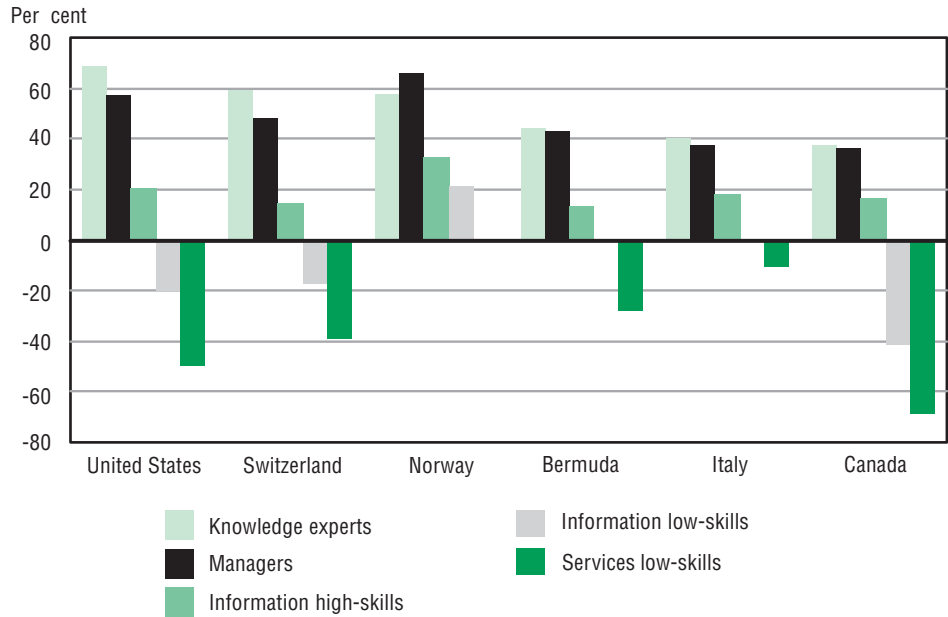
Source: Adult Literacy and Life Skills Survey, 2003.

Earnings premiums reported in Figure 7.2 are calculated as the percentage difference of expected weekly earnings for each occupational type relative to “goods related” or manufacturing type occupations. Experts and managers earn the most in all countries, with premiums on the order of 36 to 68 per cent. High-skill information jobs earn an average premium of 13 to 33 per cent, while low-skill information jobs earn less than manufacturing type jobs in Canada, Italy, Switzerland and the United States. In Bermuda and Norway, low-skill information jobs earn more on average than “goods related” occupations. In all countries, low-skills service occupations earn less on average than manufacturing employment. This ranges from as low as 69 per cent in Canada to eight per cent in Norway.

FIGURE 7.2

Earnings premiums associated with occupational types

Per cent difference of expected weekly earnings for each occupational type relative to “goods related” occupations, labour force populations aged 16 to 65, 2003



Countries are ranked by the earnings premium associated with expert occupations.

1. Difference estimates that are not statistically different from “goods related” occupations at conventional levels of significance are set to zero in the figure.

Source: Adult Literacy and Life Skills Survey, 2003.

Box 7A

Estimating the rates of return to skill

The rates of return to skill are estimated using a structural model. The estimation method is three stage least squares. This allows for the possible correlation between some of the explanatory variables and unobserved factors, which would otherwise lead to bias, to be taken into account. The model is based on Green and Riddell (2001). Both education and observed skill are specified as endogenous variables in the first equation, which is essentially an extension of Mincer’s (1974) human capital model, and includes experience and some other factors commonly adjusted for in a model predicting earnings. The full model is based on the assumption that education affects skill proficiencies, and in turn, both skills and education influence weekly earnings.

Other control variables in the analysis are potential work experience, gender, community size, parents’ education and non-native language. The instrumental variable used for education is the respondent’s age when the highest level of schooling was completed, which is thought to affect directly educational attainment but not directly earnings. Non-native language is the instrumental variable adjusting variance in skill proficiencies.

7.3 Skills, social assistance and investment income

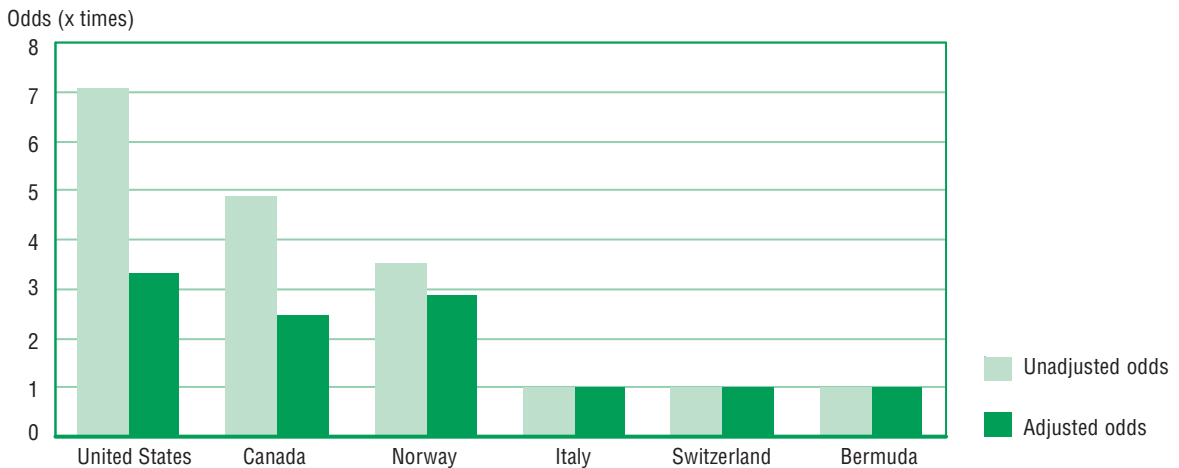
Skills yield potential economic returns to both individuals and societies beyond employment and earnings. Previous research suggests that there is an association between more education and reduced dependence on social transfers during prime working years (Kiefer, 1985; An, Haveman, and Wolfe, 1993). The findings presented in Figure 7.3 suggest that skills are a part of the explanation. Adults who score at Levels 1 and 2 on the numeracy scale are more likely to obtain social assistance payments from the state. This is the case in Canada, Norway and the United States, even after adjusting for education as well as age, gender and household income. The results are rather similar for the other domains measured. In Bermuda, Italy and Switzerland, the relationship is not significant when education and household income are taken into account.

Many adults have difficulties to earn sufficient income because they do not have the literacy and numeracy skills needed to cope with modern working life. For example, numeracy was shown to be associated with employability in Chapter 5. Other previous research shows that low skills are a common barrier to employment among recipients of social assistance, and that individuals who fail to obtain remedial education have lower odds of succeeding in the labour market (Heinrich, 1998; Danziger et al., 1999).

FIGURE 7.3

Likelihood of low-skilled adults collecting social assistance payments

Adjusted and unadjusted odds ratios¹ showing the likelihood of low-skilled adults (Levels 1 and 2) collecting social assistance payments, numeracy scale, populations aged 16 to 65, 2003



Countries are ranked according to the difference in the unadjusted odds.

1. Odds estimates that are not statistically different from one at conventional levels of significance are set to one in the figure.

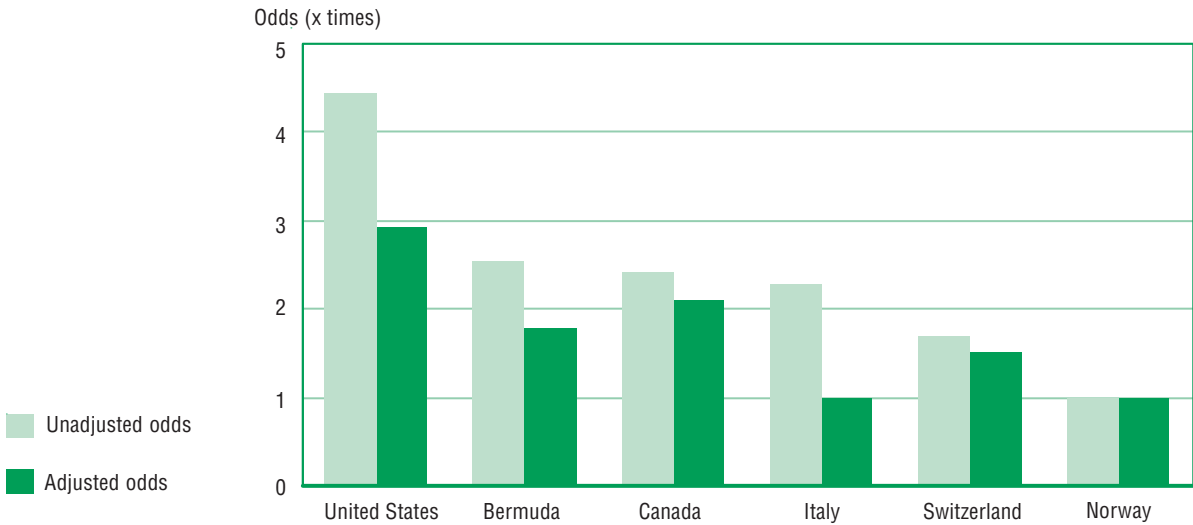
Source: Adult Literacy and Life Skills Survey, 2003.

Figure 7.4 shows the relationship between skills and the likelihood of earning income from interest, dividends, capital gains or other investment income such as net rental income. Previous research provides some evidence that more schooling is associated with higher savings rates (Solomon 1975). But even after adjusting for levels of education and income, the findings show that in Bermuda, Canada, Switzerland and the United States, medium to high skilled adults (Levels 3 and 4/5) are more likely to earn investment income. In Italy, there is a relationship but not above and beyond the effect of education and household income on wealth. This suggests that in most countries, numeracy skills are a prerequisite to individuals realizing investment income.

FIGURE 7.4

Likelihood of medium to high-skilled adults earning investment income

Adjusted and unadjusted odds ratios¹ showing the likelihood of medium to high-skilled adults (Levels 3 and 4/5) earning investment income, numeracy scale, populations aged 16 to 65, 2003



Countries are ranked according to the difference in the unadjusted odds.

1. Odds estimates that are not statistically different from one at conventional levels of significance are set to one in the figure.
 Source: Adult Literacy and Life Skills Survey, 2003.

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Annex 7

Data Values for the Figures

TABLE 7.1

Three stage least squares estimates of the effect of observed skills (percentile scale) on weekly log-earnings, prose, document, numeracy and problem solving scales, labour force populations aged 16 to 65, 2003

	Prose literacy		Document literacy		Numeracy		Problem solving ¹	
Bermuda								
Observed skills (percentiles)	0.18***	(0.05)	0.37***	(0.06)	0.25***	(0.05)	0.29***	(0.07)
Years of schooling	0.01	(0.02)	-0.07	(0.03)	-0.02	(0.02)	-0.01	(0.02)
Years of experience	0.04***	(0.00)	0.04***	(0.01)	0.04***	(0.00)	0.03***	(0.01)
Years of experience-squared	0.00***	(0.00)	0.00***	(0.00)	0.00***	(0.00)	0.00***	(0.00)
Male	0.39***	(0.04)	0.26***	(0.04)	0.16***	(0.05)	0.41***	(0.04)
Urban resident	4.98***	(0.10)	5.16***	(0.12)	5.25***	(0.12)	4.71***	(0.12)
Canada								
Observed skills (percentiles)	0.09***	(0.01)	0.11***	(0.01)	0.13***	(0.01)	0.08***	(0.01)
Years of schooling	0.06***	(0.00)	0.05***	(0.00)	0.04***	(0.01)	0.07***	(0.00)
Years of experience	0.06***	(0.00)	0.06***	(0.00)	0.06***	(0.00)	0.06***	(0.00)
Years of experience-squared	0.00***	(0.00)	0.00***	(0.00)	0.00***	(0.00)	0.00***	(0.00)
Male	0.42***	(0.02)	0.37***	(0.01)	0.30***	(0.02)	0.39***	(0.01)
Urban resident	0.04	(0.02)	0.04	(0.02)	0.02	(0.02)	0.03	(0.02)
Italy								
Observed skills (percentiles)	0.35***	(0.09)	0.40***	(0.19)	-0.06	(0.10)	0.38***	(0.10)
Years of schooling	-0.03	(0.02)	-0.05***	(0.04)	0.07***	(0.03)	-0.03	(0.02)
Years of experience	0.01	(0.01)	0.01***	(0.01)	0.02***	(0.01)	0.00	(0.01)
Years of experience-squared	0.00	(0.00)	0.00***	(0.00)	0.00**	(0.00)	0.00**	(0.00)
Male	0.37***	(0.05)	0.21***	(0.05)	0.24***	(0.03)	0.34***	(0.05)
Urban resident	0.00	(0.04)	0.00***	(0.06)	0.07***	(0.04)	-0.05	(0.05)
Norway								
Observed skills (percentiles)	0.05	(0.08)	0.08	(0.08)	0.05	(0.07)	0.00	(0.07)
Years of schooling	0.06***	(0.02)	0.05***	(0.02)	0.06**	(0.02)	0.07***	(0.02)
Years of experience	0.07***	(0.01)	0.07***	(0.01)	0.07***	(0.01)	0.07***	(0.01)
Years of experience-squared	0.00***	(0.00)	0.00***	(0.00)	0.00***	(0.00)	0.00***	(0.00)
Male	0.34***	(0.04)	0.29***	(0.07)	0.28***	(0.08)	0.34***	(0.04)
Urban resident	0.30***	(0.05)	0.30***	(0.05)	0.31***	(0.05)	0.32***	(0.05)

TABLE 7.1 (concluded)

**Three stage least squares estimates of the effect of observed skills
(percentile scale) on weekly log-earnings, prose, document, numeracy and
problem solving scales, labour force populations aged 16 to 65, 2003**

	Prose literacy		Document literacy		Numeracy		Problem solving ¹	
Switzerland								
Observed skills (percentiles)	0.03	(0.03)	0.04*	(0.02)	0.02	(0.02)	0.03	(0.03)
Years of schooling	0.07***	(0.01)	0.07***	(0.01)	0.08***	(0.01)	0.08***	(0.01)
Years of experience	0.04***	(0.00)	0.04***	(0.00)	0.04***	(0.00)	0.04***	(0.00)
Years of experience-squared	0.00***	(0.00)	0.00***	(0.00)	0.00***	(0.00)	0.00***	(0.00)
Male	0.72***	(0.03)	0.69***	(0.03)	0.69***	(0.03)	0.72***	(0.03)
Urban resident	0.18***	(0.03)	0.18***	(0.03)	0.18***	(0.03)	0.18***	(0.03)
United States								
Observed skills (percentiles)	0.05*	(0.03)	0.06	(0.03)	0.08**	(0.04)	...	...
Years of schooling	0.09***	(0.02)	0.09***	(0.02)	0.07***	(0.02)	...	...
Years of experience	0.06***	(0.01)	0.06***	(0.01)	0.06***	(0.01)	...	...
Years of experience-squared	0.00***	(0.00)	0.00***	(0.00)	0.00***	(0.00)	...	...
Male	0.50***	(0.04)	0.47***	(0.04)	0.42***	(0.05)	...	...
Urban resident	0.15***	(0.05)	0.15***	(0.05)	0.15***	(0.06)	...	...

* p<0.10, statistically significant at the 10 per cent level.

** p<0.05, statistically significant at the 5 per cent level.

*** p<0.01, statistically significant at the 1 per cent level.

... Not applicable.

1. Switzerland (Italian) and the United States did not field the problem solving skills domain.

Note: The results reported in the table are from the first equation of the three equation system. The estimates for the other two equations are available upon request.

Source: Adult Literacy and Life Skills Survey, 2003.

TABLE 7.2

Per cent difference of expected weekly earnings for each occupational type relative to “goods related” occupations, labour force populations aged 16 to 65, 2003

Bermuda		
Experts	44.6***	(0.06)
Managers	43.0***	(0.07)
Information high-skills	13.2 *	(0.07)
Information low-skills	4.3	(0.06)
Services low-skills	-27.8***	(0.07)
Canada		
Experts	37.1***	(0.04)
Managers	36.0***	(0.04)
Information high-skills	16.4***	(0.04)
Information low-skills	-41.3***	(0.03)
Services low-skills	-68.6***	(0.04)
Italy		
Experts	40.0***	(0.07)
Managers	37.2***	(0.08)
Information high-skills	18.1***	(0.04)
Information low-skills	-2.6	(0.04)
Services low-skills	-10.2 *	(0.06)
Norway		
Experts	57.9***	(0.08)
Managers	65.5***	(0.10)
Information high-skills	32.7***	(0.07)
Information low-skills	21.1***	(0.08)
Services low-skills	-7.9	(0.08)
Switzerland		
Experts	59.2***	(0.10)
Managers	48.2***	(0.08)
Information high-skills	14.4 *	(0.09)
Information low-skills	-17.6 *	(0.09)
Services low-skills	-39.0***	(0.11)
United States		
Experts	68.3***	(0.07)
Managers	57.1***	(0.07)
Information high-skills	20.9***	(0.08)
Information low-skills	-19.9***	(0.06)
Services low-skills	-49.8***	(0.07)

* p<0.10, statistically significant at the 10 per cent level.

** p<0.05, statistically significant at the 5 per cent level.

*** p<0.01, statistically significant at the 1 per cent level.

Note: Values in brackets are standard errors for the per cent estimates divided by 100.

Source: Adult Literacy and Life Skills Survey, 2003.

TABLE 7.3

Adjusted and unadjusted odds ratios showing the likelihood of low skilled adults (Levels 1 and 2) collecting social assistance payments, numeracy scale, populations aged 16 to 65, 2003

	Adjusted odds ¹		Unadjusted odds	
Bermuda	1.00	(1.0)	2.11	(1.0)
Canada	2.45***	(0.2)	4.89***	(0.2)
Italy	2.13	(0.8)	3.49	(0.8)
Norway	2.86**	(0.4)	3.52***	(0.4)
Switzerland	1.92	(0.7)	2.61	(0.6)
United States	3.32**	(0.5)	7.06***	(0.4)

* p<0.10, statistically significant at the 10 per cent level.

** p<0.05, statistically significant at the 5 per cent level.

*** p<0.01, statistically significant at the 1 per cent level.

1. Odds are adjusted for gender, age, educational attainment and total personal income.

Note: Standard errors are of the logarithm of the odds ratios.

Source: Adult Literacy and Life Skills Survey, 2003.

TABLE 7.4

Adjusted and unadjusted odds ratios showing the likelihood of medium to high skilled adults (Levels 3 and 4/5) earning investment income, numeracy scale, populations aged 16 to 65, 2003

	Adjusted odds ¹		Unadjusted odds	
Bermuda	1.77***	(0.18)	2.54***	(0.12)
Canada	2.10***	(0.13)	2.42***	(0.10)
Italy	1.36	(0.28)	2.28***	(0.26)
Norway	0.98	(0.20)	1.32	(0.17)
Switzerland	1.52**	(0.15)	1.68***	(0.09)
United States	2.93***	(0.19)	4.44***	(0.15)

* p<0.10, statistically significant at the 10 per cent level.

** p<0.05, statistically significant at the 5 per cent level.

*** p<0.01, statistically significant at the 1 per cent level.

1. Odds are adjusted for gender, age, educational attainment and total personal income.

Note: Standard errors are of the logarithm of the odds ratios.

Source: Adult Literacy and Life Skills Survey, 2003.

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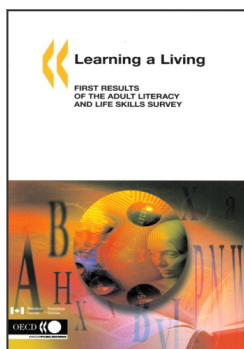
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